UNION SWITCH & SIGNAL

645 Russell Street
Batesburg, SC 29006

SERVICE MANUAL 6700B

GENISYS SERIES 2000

Multi-Purpose Communication Products

- **Installation**
- **Operation**
- **Field Programming**
- **Field Maintenance**

June 1996

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ILLUSTRATIONS

TABLES

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I. GENERAL INFORMATION

1.1 RELATED MANUALS

This manual describes field installation, programming, operation and maintenance procedures for selected applications of the GENISYS® Series 2000 product family, including:

A. ATCS-compliant mobile communications processor interface

B. US&S GENISYS®, Harmon MCS-1 or WB&S S2 serial code line interfaces

C. US&S 500-series or GRS-K series dc code line interfaces

Another manual covering GENISYS® Series 2000 components is:

SM-6700A GENISYS® Series 2000 Application Logic Programming*

*SM-6700A covers all GENISYS® Series 2000 applications except Protocol Converter.

Any manuals covering special applications of the GENISYS® Series 2000 components fall within the 6700 series (e.g. SM-6700E, SM-6700F).

Because the Enhanced Controller PCB may be used in GENISYS® and MICROLOK-PLUS™ systems, field and shop information on this PCB is also appended to:

SM-6300B GENISYS® Non-Vital Logic Emulator/MICROLOK-PLUS™ Vital + Non-Vital Control Package - Field Installation and Maintenance

Contact US&S at 1-800-652-7276 for these other manuals. (Manuals may also be obtained through any US&S Field Sales Office.)

NOTE

Selected GENISYS® Series 2000 components are integral to the operation of the GENISYS® Non-Vital Logic Emulator and MICROLOK-PLUS™ Vital + Non-Vital Control Package. The manuals for these products must be used in conjunction with this manual for proper installation, operation and maintenance of these systems.

1.2 FORMAT OF MANUAL

Each GENISYS® Series 2000 component is covered in a separate section of the manual:

Section II	Enhanced Controller PCB
Section III	32-Bit Output PCBs 32-Bit Input PCB

Section IV	Power Supply PCB DC Code Line PCB DC Code Line/Power Supply PCB
Section V	Surge Suppressor/Serial Interface Panel
Section VI	Card Enclosure

In addition, specific applications of this equipment are contained in specific sets of pages with the application denoted at the top corner of the page, including:

ATCS MCP
GENISYS®
MCS-1
WB&S S2
US&S 500 DC
GRS K DC

Pages covering subjects applicable to all of the above are denoted with "**ALL APPLICATIONS**" at the top.

1.3 INTRODUCTION

1.3.1 General (Ref. Figures 1-1, 1-2, 1-3)

GENISYS® Series 2000 product line is used for a variety of communication interfacing and non-vital logic functions. Basic applications include:

Application	Description
CTC/ATCS BCP Interface	Direct interface between a CTC communications circuit employing a US&S PRCCI™ protocol and an ATCS-compliant radio Base Communications Processor (BCP).
ATCS MCP Interface	Direct interface between an ATCS-compliant radio Mobile Communications Processor (MCP) and US&S vital interlocking controllers*:
Serial Code Line Interface	Direct interface between US&S GENISYS, Harmon MCS-1 and WB&S S2 serial code lines and US&S vital interlocking controllers*
DC Code Line Interface	Direct interface between selected DC code lines and US&S vital interlocking controllers:

In applications where the GENISYS® Series 2000 Controller board is part of a field code unit, the system also performs non-vital logic functions (e.g. local I/O control, Local Control Panel interface), in addition to the above communications interfacing functions.

As shown in the right-hand part of Figure 1-1, GENISYS® Series 2000 components enable a direct interface between an ATCS-compliant Mobile Communications Processor (MCP) and US&S vital interlocking controllers*. If a new field installation requires local non-vital I/O (e.g. to a local control panel), the Enhanced Controller is housed in a GENISYS® or MICROLOK-PLUS™ cardfile. Existing GENISYS® or MICROLOK-PLUS™ installations can be retrofit with the Enhanced Controller to create the interface to the MCP. If there is no requirement for non-vital local I/O, the Enhanced Controller can be housed in the GENISYS Series 2000® Card Enclosure. Regardless of the installation, the Enhanced Controller contains the same interfacing/conversion software for the communications link with the MCP.

As shown in Figure 1-2, GENISYS® Series 2000 components also enable a direct interface between selected serial code line carriers and US&S vital interlocking controllers*. Installation options for the Enhanced Controller are the same as those for the MCP application (refer to above paragraph). Different communications handling software is provided for each serial code line application.

In both the ATCS MCP and serial code line applications, an optional Surge Suppression/Serial Interface Panel is available to protect Enhanced Controller PCB circuits from potentially damaging transient voltages.

As shown in Figure 1-3, GENISYS® Series 2000 components also enable a direct interface between selected DC code lines and US&S vital interlocking controllers*. As with the ATCS MCP and serial code line applications, the Enhanced Controller can be installed in GENISYS® or MICROLOK-PLUS™ cardfiles to manage non-vital local I/O, or in the GENISYS® Series 2000 Card Enclosure when the local I/O is not present. The GENISYS® Series 2000 DC Code Line PCB provides the electrical interface between the Enhanced Controller and the DC Code Line. Different communications handling software is provided for each DC code line application.

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* MICROLOK® Vital Interlocking Control System
MICROLOK-PLUS™ Vital + Non-Vital Control Package
MICROTRAX® Coded Track Circuit/End-of-Siding Controller

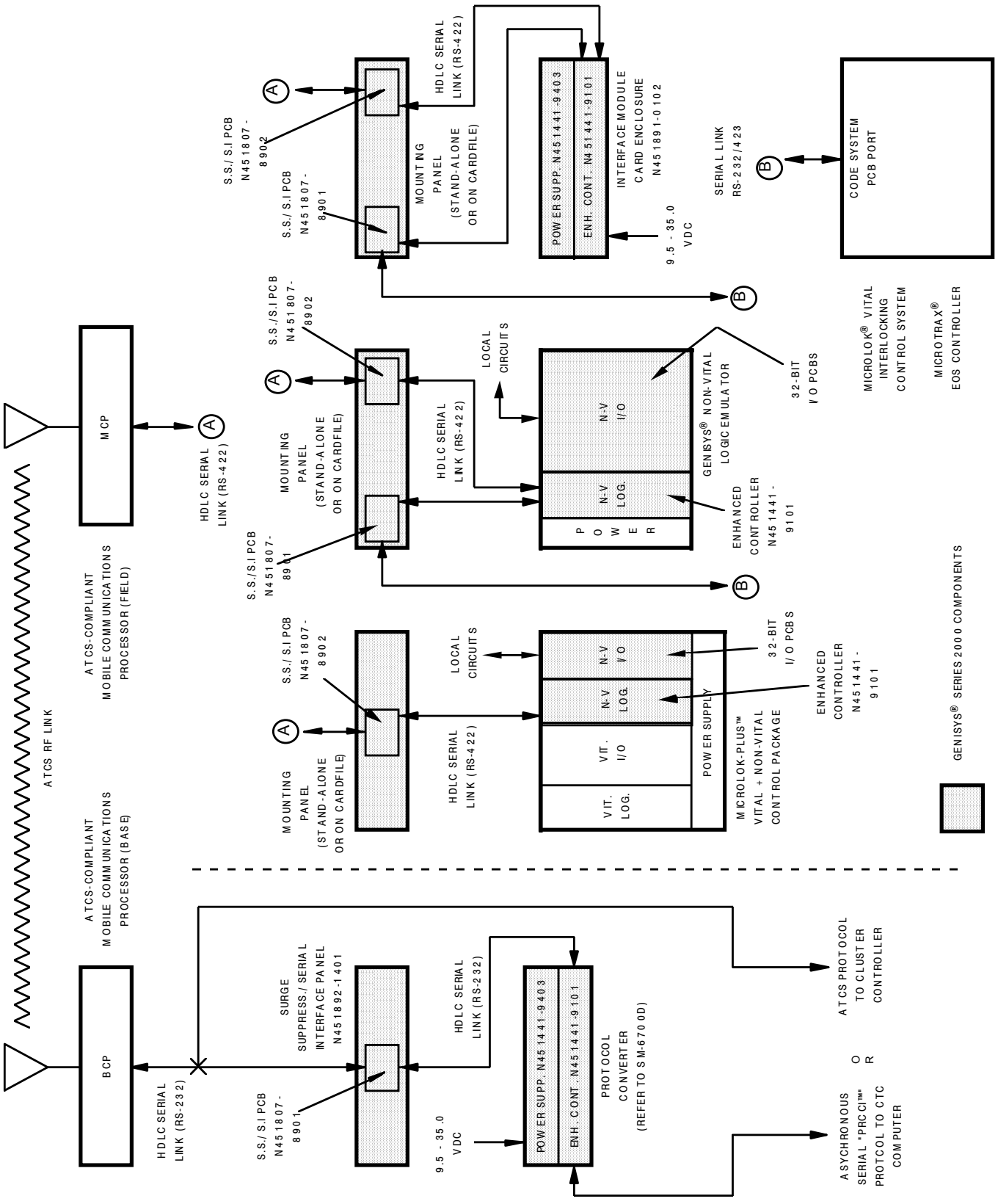

Figure 1-1. ATCS Communications Interface

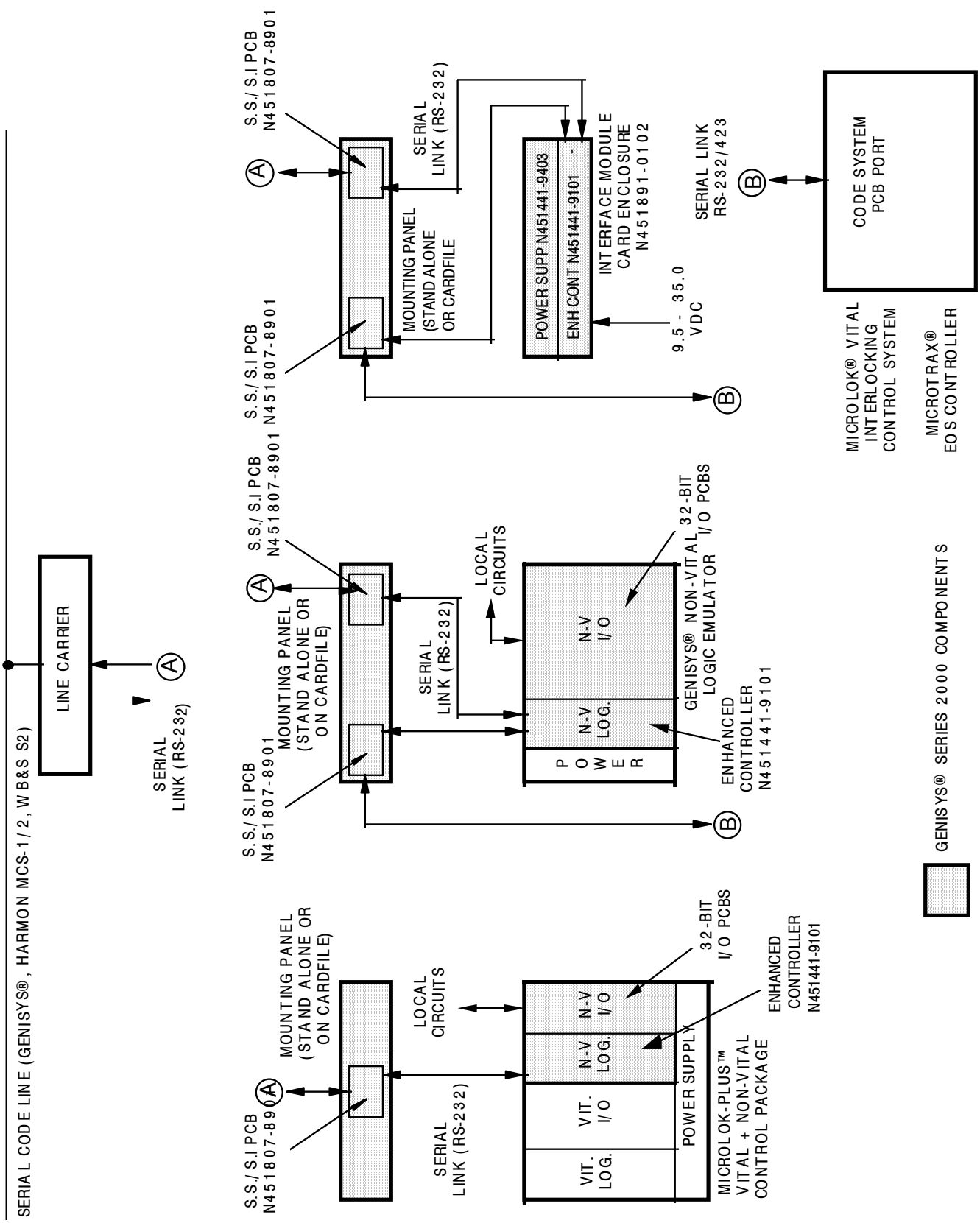

Figure 1-2. Serial Code Line Interface

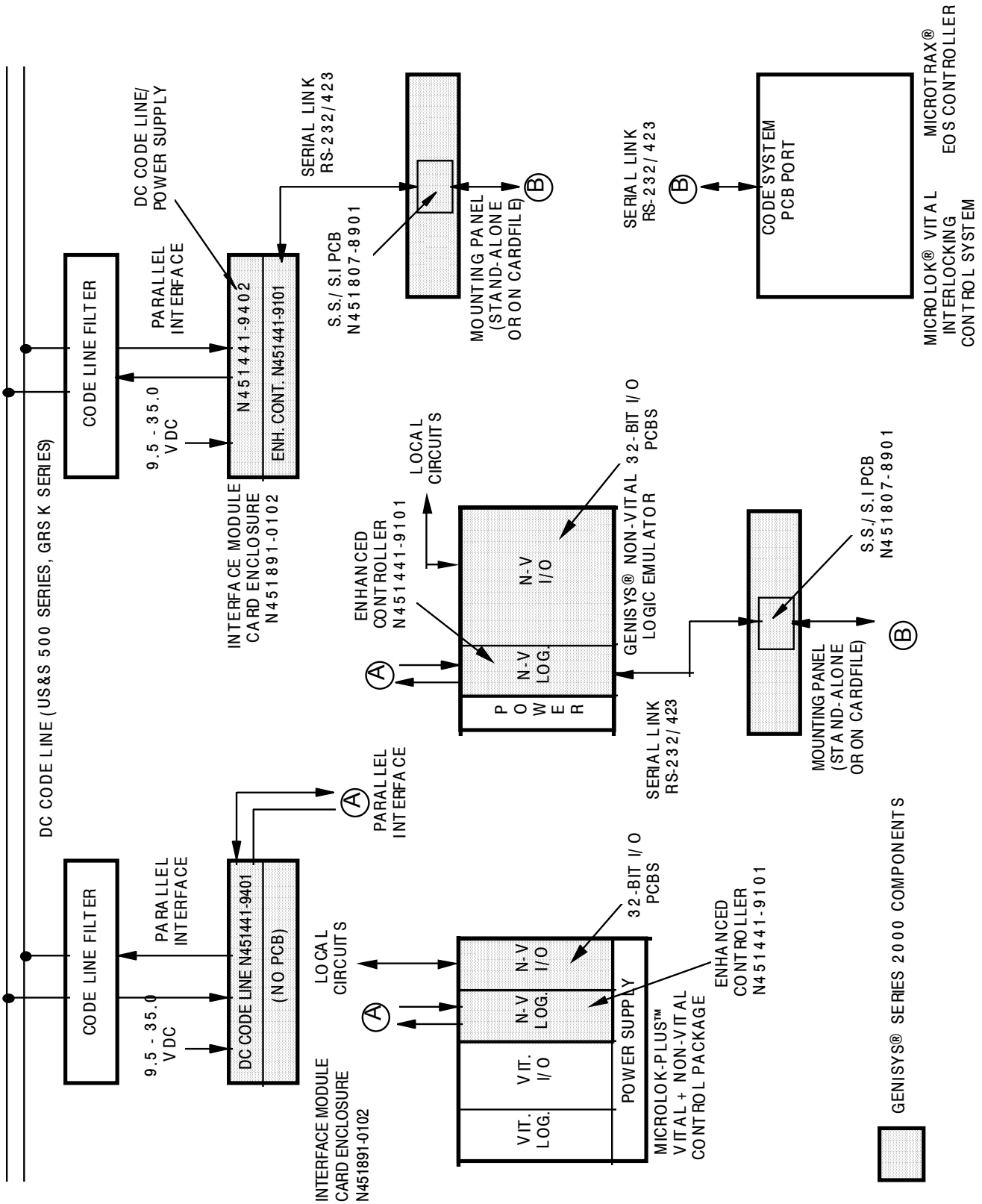

Figure 1-3. DC Code Line Interface

1.3.2 Components

GENISYS® Series 2000 component part numbers include:

Component	US&S Part No.
Enhanced Controller PCB	N451441-9101
32-Bit Output PCBs	N451441-9601, -9801
32-Bit Input PCB	N451441-9701
Code Line Interface PCB	N451441-9401
Code Line Interface/Power Supply PCB	N451441-9402
Power Supply PCB	N451441-9403
Card Enclosure	N451891-0102
Surge Suppressor/Serial Interface Panel	N451892-1401
Surge Suppressor/Serial Interface PCBs	N451807-8901, -8902
GENISYS® Series 2000 Development System (G2DS)	N451232-0120, -0121
Executive PROM Sets	N451800-0201 to -020X

1.3.2.1 Enhanced Controller Board (N451441-9101) and Software

The Enhanced Controller PCB is used in all GENISYS® Series 2000 applications. It contains circuitry and software for performing non-vital logic functions in GENISYS® and MICROLOK-PLUS™ units, as well as the various communications interfacing functions in ATCS, serial code line and DC code line applications. When used in GENISYS® and MICROLOK-PLUS™ units, this board performs the same logic and local I/O interfacing functions as the N451441-5602 Controller. (The -5602 board does not have the signal interfacing/protocol conversion capabilities of the -9101 board). When used in the stand-alone field interface to a MICROLOK® or MICROTRAX End-of-Siding system (Reference Figures 1-1 through 1-3), the Enhanced Controller Board is housed in the GENISYS® Series 2000 Card Enclosure.

The Enhanced Controller PCB operates with both Executive and Application software. Executive PROM sets accommodate the different communications protocols (e.g. ATCS, MCS), while Application EPROMs contain the operating logic designed via the GENISYS® Series 2000 Development System (G2DS). The G2DS is not compatible with the GENISYS® Development System (GDS). Refer to Section II, Enhanced Controller PCB N451441-9101, for a detailed description of the Enhanced Controller Board.

1.3.2.2 32-Bit Output Boards (N451441-9601, -9801)

The 32-Bit Output boards are used in GENISYS® Series 2000 field code unit applications that drive local relays. These boards are installed in the 18-PCB GENISYS® cardfile or in the non-vital section of the MICROLOK-PLUS™ cardfile. They can only be used with the Enhanced Controller PCB; output type is selected by jumpers. The 32-bit boards differ only in direction of relay drive voltage (source or sink). Refer to Section III, 32-Bit Input PCB N451441-9701, 32-Bit Input PCB N451441-9601, 32-Bit Output PCB N451441-9801, for detailed descriptions of the 32-Bit Output boards.

1.3.2.3 32-Bit Input Board (N451441-9701)

The 32-Bit Input board is used in GENISYS® Series 2000 field code unit applications that take inputs from local relay contacts. This board is installed in the 18-PCB GENISYS® cardfile or in the non-vital section of the MICROLOK-PLUS™ cardfile. It is only compatible with the Enhanced Controller PCB, and provides the same type of relay contact inputs as the earlier 16-bit input boards. Refer to Section III, 32-Bit Input PCB N451441-9701, 32-Bit Output PCB N451441-9601, 32-Bit Output PCB N451441-9801, for a detailed description of the 32-Bit Input board.

1.3.2.4 Code Line Interface/Power Supply Board (N451441-9402)

This board is used in DC code line applications and is housed in the Card Enclosure with the Enhanced Controller (Ref. Figure 1-3). The -9402 board contains power supply components to convert external input voltage to levels compatible with the Enhanced Controller. It also contains components for conversion of DC code signal voltages to signal levels compatible with the Enhanced Controller's logic, and vice-versa. Refer to Section IV, Code Line Interface PCB N451441-9401, Code Line Interface/Power Supply PCB -9042, Power Supply PCB N451441-9403, for a detailed description of this board.

1.3.2.5 Code Line Interface Board (N451441-9401)

This board is used exclusively in DC code line applications where the Enhanced Controller Board is installed in GENISYS® or MICROLOK-PLUS™ units (Ref. Figure 1-3). The -9401 board only contains components for converting DC code line voltages to levels compatible with the Enhanced Controller, and vice-versa. Power supply components are absent. The -9401 board is used in applications where logic power is available from another source such as a GENISYS®, MICROLOK® or MICROTRAX® cardfile. Refer to section IV, Code Line Interface PCB N451441-9401, Code Line Interface/Power Supply PCB -9042, Power Supply PCB N451441-9403, for a detailed description of this board.

1.3.2.6 Power Supply Board (N451441-9403)

This board is used in ATCS and serial code line applications, and is housed in the Card Enclosure along with the Enhanced Controller to provide regulated operating power to the Controller (Ref. Figures 1-1 and 1-2). The application of -9403 board covered in this manual consists of the field stand-alone interface to a MICROLOK® or MICROTRAX® End-of-Siding system. Refer to section IV, Code Line Interface PCB N451441-9401, Code Line Interface/Power Supply PCB -9042, Power Supply PCB N451441-9403, for a detailed description of this board.

1.3.2.7 Card Enclosure (N451891-0102)

The GENISYS® Series 2000 Card Enclosure is provided to house the DC Code Line Interface PCB (-9401) and, for certain applications, the Enhanced Controller PCB. The most common application of the enclosure is connection of a GENISYS® or MICROLOK-PLUS™ unit to a DC code line. In this application, the enclosure houses only the DC Code Line Interface PCB, while the Enhanced Controller PCB is housed in the GENISYS® or MICROLOK-PLUS™ cardfile.

When the application requires an interface between a MICROLOK® or MICROTRAX® End-of-Siding System, the card enclosure also contains the Enhanced Controller PCB. In this configuration, the enclosure also contains the alternate Code Line Interface/Power Supply PCB, which includes a logic-

level power supply for the Enhanced Controller. This configuration is used when the external unit (to which the Enhanced Controller is connected) is not capable of powering the controller.
Because of the many possible system configurations, the enclosure and appropriate PCBs must be ordered separately. Refer to section VI, Code Line Interface PCB N451441-9401, Code Line Interface/Power Supply PCB -9042, Power Supply PCB N451441-9403, for a detailed description of the Card Enclosure.

1.3.2.8 Surge Suppressor/Serial Interface PCBs and Panels

GENISYS® Series 2000 Surge Suppressor/Serial Interface PCBs are used in ATCS (office and field) and serial code line applications to protect the Enhanced Controller from transient voltages (e.g. lightning-induced) on the serial communications interfaces (Ref. Figures 1-1 and 1-2). In addition, the PCBs interface RS-232 and RS-422 signal levels to the Enhanced Controller PCB. PCB part numbers are N451807-8901 and N451807-8902.

PCB -8901 is used for all RS-232 serial interfaces, but not the RS-422 interface used in the MCP end of the ATCS communications link. PCB -8902 is used only for the RS-422 interface to the MCP.

Mounting Panel N451892-1401 allows 19” rack mounting of the above PCBs adjacent to an existing GENISYS® or MICROLOK-PLUS™ cardfile, or the GENISYS® Series 2000 card enclosure. GENISYS® and MICROLOK-PLUS cardfiles are also available with built-in mounting panel for the PCBs. Contact US&S for ordering information.

1.3.2.9 Summary

Table 1-1 summaries the application of the various GENISYS® Series 2000 components to new and existing communications systems. Office protocol converter applications are included for reference (refer to SM-6700D for details).

Table 1-1. GENISYS ® Series 2000 Component Applications (Except Protocol Converter)

APPLICATION	ENHANCED CONTROLLER PCB N451441-9101	EXECUTIVE SOFTWARE (PROM SETS)*	CODE LINE INTF. PCB/POWER SUPPLY PCBS	CARD ENCLOSURE N451891-0102	SURGE SUPPRESS./ SERIAL INTERFACE PCB(S)	32-BIT OUTPUT PCBS N451441-9601, -9801 32-BIT INPUT PCB N451441-9701
ATCS-compliant MCP to GENISYS® or MICROLOK-PLUS™ unit. See Fig. 1-1.	In GENISYS® or MICROLOK-PLUS™ unit	ATCS: N451800-0201	(None)	(None)	MCP Interface: N451807-8902 GENISYS®/MICROLOK-PLUS™ Interface: N451807 8901	In GENISYS® or MICROLOK-PLUS™ unit, if req'd by appli-cation.
ATCS-compliant MCP to MICROLOK® unit. See Figure 1-1.	In Stand-Alone Interface Assy.	ATCS: N451800-0201	Power Supply: N45144-1 9403	Function: Stand-Alone Interface	MCP Interface: N451807 8902 MICROLOK® Interface: N451807-8901	(None)
Serial code line to GENISYS® or MICROLOK-PLUS™ unit. See Fig. 1-2.	In GENISYS® or MICROLOK-PLUS™ unit	GENISYS®: N451800-0202, -0203 Harmon MCS-1: N451800-0204 WB&S S2: N451800-020X	(None)	(None)	Carrier Modem Interface: N451807-8901 GENISYS®/MICROLOK-PLUS™ Interface: N451807-8901	In GENISYS® or MICROLOK-PLUS™ unit, if req'd by appli-cation.
Serial code line to MICROLOK® unit. See Figure 1-2.	In Stand-Alone Interface Assy.	GENISYS®: N451800-0202, -0203 Harmon MCS-1: N451800-0204 WB&S S2: N451800-020X	Power Supply: N45144-1 9403	Function: Stand-Alone Interface	Carrier Modem Interface: N451807-8901 MICROLOK® Interface: N451807-8901	(None)
DC code line to GENISYS® or MICROLOK-PLUS™ unit. See Fig. 1-3.	In GENISYS® or MICROLOK-PLUS™ unit	US&S 500 Series: N451800-0202 GRS K Series: N451800-0203	Code Line Interface: N451441-9401	Function: Code Line Interface	GENISYS®/MICROLOK-PLUS™ Interface: N45180-7 8901 (Optional)	In GENISYS® or MICROLOK-PLUS™ unit, if req'd by appli-cation.
DC code line to MICROLOK® unit. See Figure 1-3.	In Code Line Interface Assy.	US&S 500 Series: N451800-0202 GRS K Series: N451800-0203	Code Line Interface/ Power Supply: N451441-9402	Function: Stand-Alone Interface	GENISYS®/MICROLOK-PLUS™ Interface: N45180-7 8901 (Optional)	(None)

*PROM set N451800-0202 contains both US&S GENISYS ® and 500-Series conversion software.

PROM set N451800-0203 US&S GENISYS ® and GRS K-Series conversion software.

1.4 SYSTEM SPECIFICATIONS

ATCS Radio Interface:	ATCS-compliant mobile communications processor (Motorola MCP or equivalent) over HDLC serial link
Communications Interfaces:	ATCS-compliant BCP:
	ATCS-compliant MCP: EIA RS-422
	GENISYS® Master and Slave: EIA RS-423 (RS-232C/422 compatible)
	No TTL capability
GENISYS® Master/Slave System:	Up to 64 Slave units (typical maximum)
Serial Code Line Protocols:	US&S GENISYS® Harmon MCS-1 WB&S S2
DC Code Line Protocols:	US&S 504B, 504C, 506, 506A, 506C, 514 GRS K, K1, K2
Field Code Unit Non-Vital I/O:	32 bits per output PCB
	32 bits per input PCB
	GENISYS® cardfile: Up to 16 output and/or input PCBs
	MICROLOK-PLUS™ cardfile: One or two output and/or input PCBs

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ALL APPLICATIONS

2.1 DESCRIPTION (Refer to Figure 2-1)

2.1.1 General Application

The GENISYS® Series 2000 Enhanced Controller PCB manages logic and communications interfacing functions in a variety of non-vital control system applications. Basic applications covered in this manual include:

A. Interfacing of a US&S vital interlocking system* to an ATCS-compliant mobile communications processor (MCP).

B. Interfacing of a US&S vital interlocking system* to GENISYS®, Harmon MCS-1 or WB&S S2 protocol serial code lines.

C. Interfacing of a US&S vital interlocking system* to US&S 500 series or GRS K series DC code lines.

These applications are accomplished with installation of the Enhanced Controller in a GENISYS® or MICROLOK-PLUS™ cardfile, or the GENISYS® Series 2000 Card Enclosure. When used in a GENISYS® or MICROLOK-PLUS™ cardfile, the Enhanced Controller PCB also manages local non-vital inputs and outputs in the same manner as the N451441-5602 Controller board. Refer to Section I, General Information, for a more detailed description of Enhanced Controller Board applications.

2.1.2 Hardware

Enhanced Controller Board N451441-9101 is a standard GENISYS®/MICROLOK® size PCB. Two 44-way PCB connectors interface all power and data lines to the board. In a GENISYS® or MICROLOK-PLUS™ unit, the “A” (top) connector interfaces external signals via 44-way cable plug. In the GENISYS® Series 2000 Card Enclosure, the “A” connector passes signals through a motherboard to selected 25-pin “D” connectors on the rear of the enclosure. The “B” (bottom) connector passes internal signals via the cardfile or enclosure motherboard bus.

No modifications are required on the GENISYS® or MICROLOK-PLUS™ motherboard “B” connector (at Controller PCB slot) to accommodate the Enhanced Controller. However, the external cable wiring to the “A” connector differs between the -5602 and -9101 boards. When retrofitting an existing GENISYS® or MICROLOK-PLUS™ unit with the -9101 Controller, the external cable connection must be rewired (Refer to section 2.3.4).

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* MICROLOK® Vital Interlocking Control System
MICROLOK-PLUS™ Vital + Non-Vital Control Package
MICROTRAX® Coded Track Circuit/End-of-Siding Controller

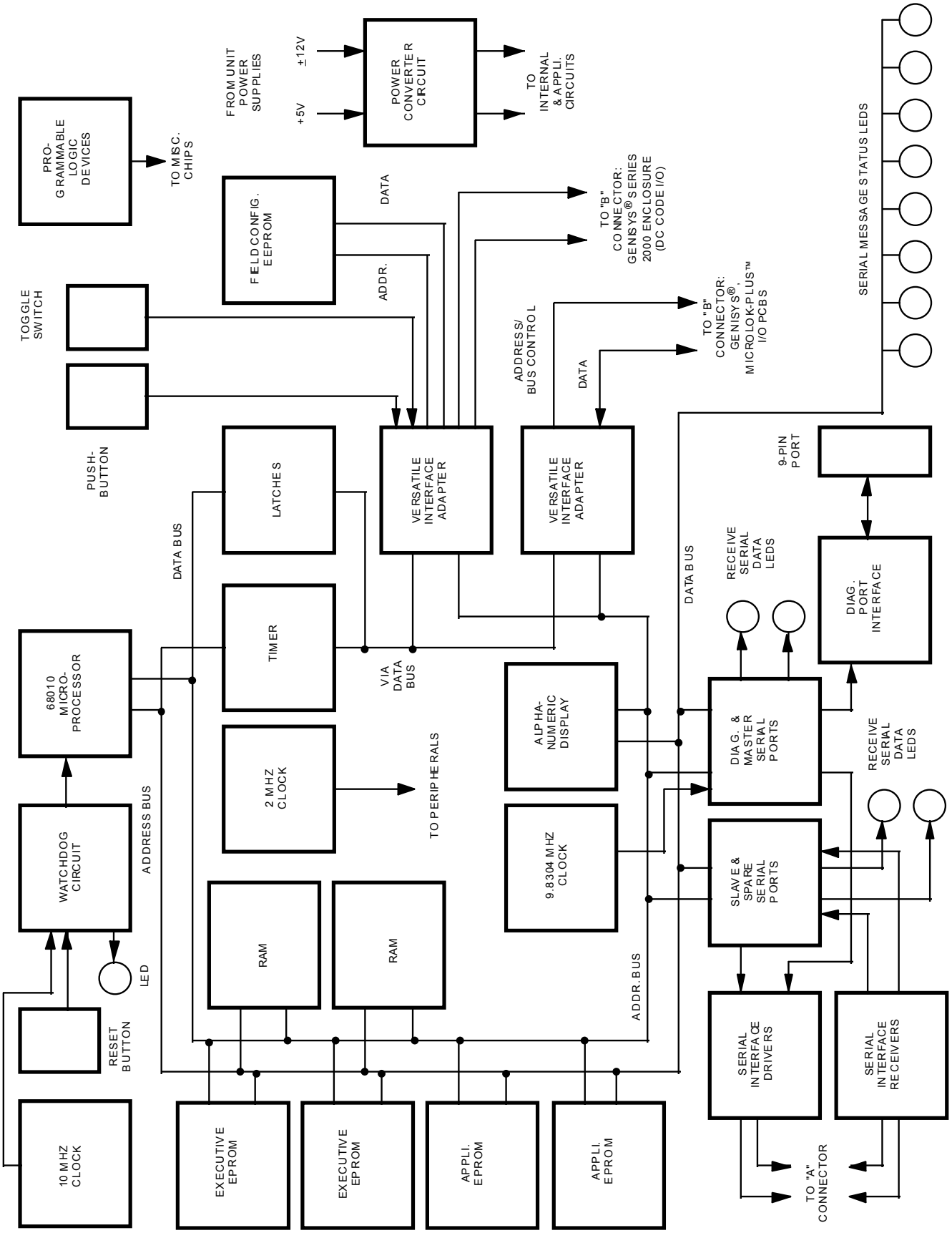


Figure 2-1. Controller PCB Block Diagram

ALL APPLICATIONS

The Enhanced Controller PCB operates from regulated +5, +12 and -12V dc sources supplied through the "B" connector. Input power is obtained from these sources:

GENISYS® cardfile:	Power Supply Converter PCB
MICROLOK-PLUS™ cardfile:	Power supply drawer
GENISYS® Series 2000 Card Enclosure:	Power Supply PCB or Code Line Interface/Power Supply PCB

Principal components of the Enhanced Controller PCB include:

Microprocessor

The Enhanced Controller PCB is managed by a 16-bit Motorola microprocessor (MC68010). This chip is used to provide enhanced performance and extended, directly accessible memory address space not available with the -5602 board. The MC68010 is driven by a 10 MHz clock signal.

EPROMs and EEPROM

Two erasable programmable read-only memory (EPROM) ICs contain the system Executive software, while two additional EPROMs contain the user-defined application software. Each of these EPROM sets has a capacity of 128K bytes. Field-configurable data is stored in a separate, electrically-erasable serial PROM (EEPROM).

RAMs

Two 32K random access memory (RAM) ICs are installed on the Enhanced Controller for storage of variable data. These ICs have a capacity of 64KB x 8 bit bytes.

Parallel I/O VIAs

Two 6522 Versatile Interface Adapter (VIA) ICs on this board interface parallel data lines to the microprocessor. One VIA handles these functions:

4 inputs:	DC code system*
4 outputs:	DC code system*
1 output:	Watchdog strobe
3 inputs:	Manual switches**
2 inputs/outputs:	EEPROM address and data lines

* When required by application
**Refer to "Manual Switches and Jumpers" below

The other VIA interfaces to the system Control/Indication bus, for example, to pass data between the microprocessor and the I/O boards in a GENISYS® cardfile. Lines include:

8 data bits (input/output)
8 address/bus control bits (output)

ALL APPLICATIONS

Serial Communications Controllers

The Enhanced Controller is equipped with two 85C30 Serial Communications Controllers, each with two serial data ports, that interface serial communications with the microprocessor. These ports serve but are not limited to the following uses:

Universal serial port (ATCS, GENISYS®, MCS-1, S2, Slave port)
Asynchronous serial port (GENISYS® Master port)
Asynchronous serial port (field set-up and diagnostics)*
Asynchronous serial port (spare)

*Refer to following listing.

Set-Up/Diagnostic Serial Port

A 9-pin "D" type male plug on the front edge of the Enhanced Controller permits connection of a portable PC for field set-up and diagnostics of the associated system. Refer to sections 2.3.4.8, 2.4.3 and 2.6.4 for use of this port.

Manual Switches and Jumpers

The Enhanced Controller PCB is equipped with the following user-accessible switches and jumpers:

One momentary-action pushbutton (set-up/diagnostics)*
One momentary-action pushbutton (reset)
One momentary-action, center-off toggle switch (set-up/diagnostics)*
Seven jumpers (configure serial communications lines)

*Used in conjunction with alphanumeric displays; refer to following listing.

Refer to section 2.4.2 for switch operation/settings, and section 2.3.2.2 for jumper positions.

LED Displays

Alphanumeric and individual LEDs are provided on the board for various monitoring purposes. One 4-character alphanumeric display provides encoded messages during system set-up and diagnostics, and is used in conjunction with two of the three manual switches. Seven of fifteen individual LEDs show the status of these lines:

4 LEDs (serial communications receive lines)
1 LED (control deliver output line)*
1 LED (reset line)
1 LED (watchdog strobe line)

*When used in a GENISYS® or MICROLOK-PLUS™ cardfile equipped with output PCBs.

The remaining eight LEDs are software controlled and indicate logical status of serial ports. Refer to Section 2.5 for interpretation of LED displays.

2.1.3 Communications Interfaces

2.1.3.1 Serial

The Enhanced Controller PCB is equipped with independent serial data ports for communications with:

A. PRCCI™ CTC communications circuits
B. ATCS-compliant base* and mobile communications processors
C. Serial code lines (US&S GENISYS®, Harmon MCS-1, WB&S S2)
D. Master and Slave GENISYS® and MICROLOK-PLUS™ units
E. MICROLOK® or MICROTRAX (End-of-Siding) units (via code line interface)
F. Portable PC

Except for the portable PC, these remote systems/devices are interfaced on the board's "A" connector edge. EIA RS-232, RS-422 or RS-423 signal levels are employed according to the application, however a 5V TTL interface is not available.

Serial communications parameters such as key delays and baud rates may be defined during field configuration via the front edge toggle switches and alpha-numeric display, the front edge PC port or in the application logic. Set-up of a given parameter is not limited to any one of these options; most are accessible via all three paths.

When the Enhanced Controller is used to manage other GENISYS® or MICROLOK-PLUS™ units in a Master/Slave configuration, the maximum practical limit is 64 Slaves. Refer to Section 2.3.4 for application of the serial data ports.

2.1.3.2 Parallel

The Enhanced Controller PCB is equipped with a set of signal lines for parallel communication with a DC code line. These lines reside on the board's "A" connector. Communications with the DC code line are interfaced through the GENISYS® Series 2000 Code Line Interface or Code Line Interface/Power Supply board. The code line protocol (e.g. 504, 514, K1) is selected via the Executive EPROM set and the application logic.

2.1.4 Software

The Enhanced Controller PCB operates under the control of its Executive and Application software as modified by its field configuration.

2.1.4.1 Executive

The Executive software performs certain routine operations and automatic diagnostics common to all Enhanced Controller PCBs, and is contained in two 64K byte EPROM chips. Different communications protocols are accommodated in different part numbers for these chips (two EPROMs per set). Executive software covered by this manual include:

ALL APPLICATIONS

US&S Part No.	Application
N451800-0201	ATCS-compliant MCP interface
N451800-0202	GENISYS® serial code line and US&S 500 series DC code line
N451800-0203	GENISYS® serial code line and GRS K series DC code line
N451800-0204	Harmon MCS-1 serial code line
N451800-020?	WB&S S2

Note that the -0202 and -203 EPROM sets contain both GENISYS® serial and DC code line interfacing software and may be used for either type of communications system. Upgrades to the Executive software are denoted in the revision number printed on the EPROM chip. When upgrades are implemented, users are initially notified through a US&S software Maintenance Notice.

NOTE

The Executive software used in the Enhanced Controller PCB is not compatible with Controller PCB N451441-5602.

2.1.4.2 Application

The Application software carries the user-defined logic for the particular system managed by the Enhanced Controller PCB. Field configuration parameters such as baud rates, station address etc. may also be set up via this software. Application software is contained in two 64K byte EPROMs. The software may be developed by US&S as a customer service, or with the GENISYS® Series 2000 Development System (G2DS). With the G2DS, the user may design, exercise, debug and load the application logic into the EPROMs, prior to installation on the board. When upgrades to the G2DS compiler or simulator are implemented, users are initially notified through a US&S software Maintenance Notice. G2DS software loading procedures (hard and floppy disk) are described in US&S service manual SM-6701. Refer to service manual SM-6700A, Genisys Series 2000 Application Logic Programming, for application logic programming, debugging and loading procedures.

2.1.4.3 Field Configuration

The Field Configuration software is used to set up local operating parameters for the particular unit that contains the Enhanced Controller. Included in this software are baud rates, key delays, station address, etc. Field Configuration software is contained in an erasable EEPROM. Programming may be performed by the following means:

A. Board front edge toggle switches and alpha-numeric displays

B. Portable PC plugged into the 9-pin port on the front edge of the board. (On the earlier -5602 Controller PCB, these parameters are only set up with manual switches on the board.)

C. Application software.

2.2 SPECIFICATIONS

US&S Part No.:	N451441-9101
Board Size:	Standard GENISYS®/MICROLOK® size
Installations:	GENISYS® Series 2000 Card Enclosure (lower slot)
	GENISYS® cardfile (slot J2)
	MICROLOK-PLUS™ cardfile (slot O)
Connections:	44-way PCB edge connector “A”: External communications
	44-way PCB edge connector “B”: System motherboard
	9-pin “D” (IBM compatible PC)
Slave Serial I/O Port:	EIA RS-423 (RS-232C/RS-422 compatible) Synchronous or asynchronous Baud Rates: 150 to 19,200 BPS Mode: Half or full duplex
Master Serial I/O Port:	EIA RS-423 (RS-232C compatible) Asynchronous only Baud Rates: 150 to 19,200 BPS Mode: Half or full duplex
Set-Up/Diagnostics Port:	RS-423 (RS-232C compatible) Asynchronous only Baud Rates: 150 to 19,200
TTL Serial Interface:	Not available
Master/Slave System:	64 Slave units (practical maximum)
G2DS Development System:	128K bytes in application logic (max.)
	4000 “relay coils” (max.)
	Not compatible with GENISYS® Development System (GDS)
Controlling Chip:	Motorola MC68010: 32-bit internal data bus 16-bit external data bus
Executive EPROMs:	Qty = 2 64K bytes per chip 128K total bytes

ALL APPLICATIONS

	US&S Part Numbers: N451800-0201 (ATCS radio protocol) N451800-0202 (GENISYS® serial and US&S 500-series dc code line protocols) N451800-0203 (GENISYS® serial and GRS K-series dc code line protocols) N451800-0204 (Harmon MCS-1 serial code line protocol) N451800-020X (WB&S S2 serial code line protocol)
Application Logic EPROMs:	Qty = 2 64K bytes per chip 128K total bytes US&S part no.: J715029-0596 (blank chip)
User Controls:	1 momentary pushbutton (set-up/diagnostics) 1 momentary pushbutton (reset) 1 momentary toggle (set-up/diagnostics) 7 jumpers (configure serial comm.)
User Displays:	4-character alphanumeric LED display 15 discrete LEDs (misc. function monitoring)
Board Environmental Limits:	-40^{o} to +70^{o}C 95% relative humidity (non-condensing)

ALL APPLICATIONS

2.3 INSTALLATION

2.3.1 Shipment Inspection

Prior to installation, the Enhanced Controller PCB should be inspected for possible damage during shipping. Check for loose or missing components, broken solder leads, breaks in tracks, fractures in the board material etc. Damaged boards should be returned to US&S for repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

2.3.2 Pre-Installation Preparation (Ref. Figure 2-2)

2.3.2.1 EPROMs

The Enhanced Controller PCB is shipped without Executive or Application software or EPROMs. Four EPROMs are required for normal operation, including two Executive and two Application. The sockets for these EPROMs are marked “EXEC EVEN”, “EXEC ODD” and “APPL EVEN”, “APPL ODD”. These sockets are also marked U4, U5, U6 and U7. Install the Executive and Application software EPROMs according to their labels, with the “EVEN” EPROMs going in the “EVEN” sockets and the “ODD” EPROMs going in the “ODD” sockets. When installing an EPROM, make certain the chip has the proper pin orientation and is fully inserted.

2.3.2.2 Jumpers

The Enhanced Controller PCB is equipped with seven jumpers for configuration of various communications lines and watchdog functions. Settings are as follows:

Jumper settings for GENISYS®, US&S 500-Series, GRS “K” Series, Harmon MCS-1 slave Applications

JP1	BC	JP5	BC
JP2	BC	JP6*	BC
JP3	BC	JP7**	AB
JP4	BC		

Jumper settings for ATCS MCP communications:

JP1	BC	JP5	BC
JP2	BC	JP6*	BC
JP3	AB	JP7**	AB
JP4	AB		

* Keep jumper in BC position for all applications (watchdog enable)
**Keep jumper in AB position for all applications (watchdog time out of 1200 mS)

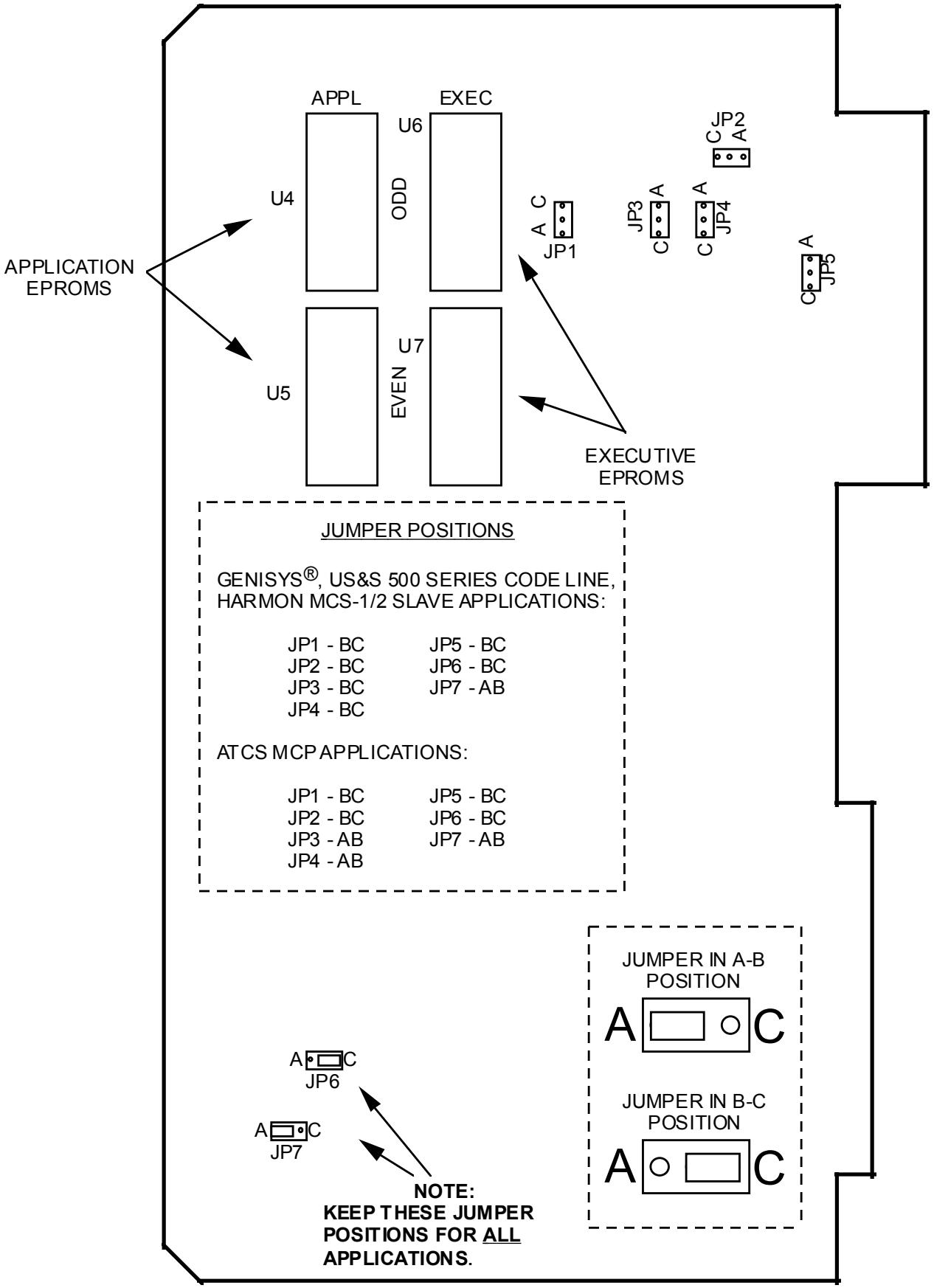


Figure 2-2. Enhanced Controller PCB: EPROM and Jumper Locations

ALL APPLICATIONS

2.3.3 Installation in Cardfile or Enclosure (Ref. Figure 2-3)

The Enhanced Controller PCB is installed in slot J2 of the GENISYS® cardfile, slot O of the MICROLOK-PLUS™ cardfile, or the lower slot of the GENISYS® Series 2000 Card Enclosure, as required by the application.

CAUTION

Make certain unit operating power is turned off while installing the enhanced controller PCB, otherwise component damage and or unreliable operation may result.

ALL APPLICATIONS

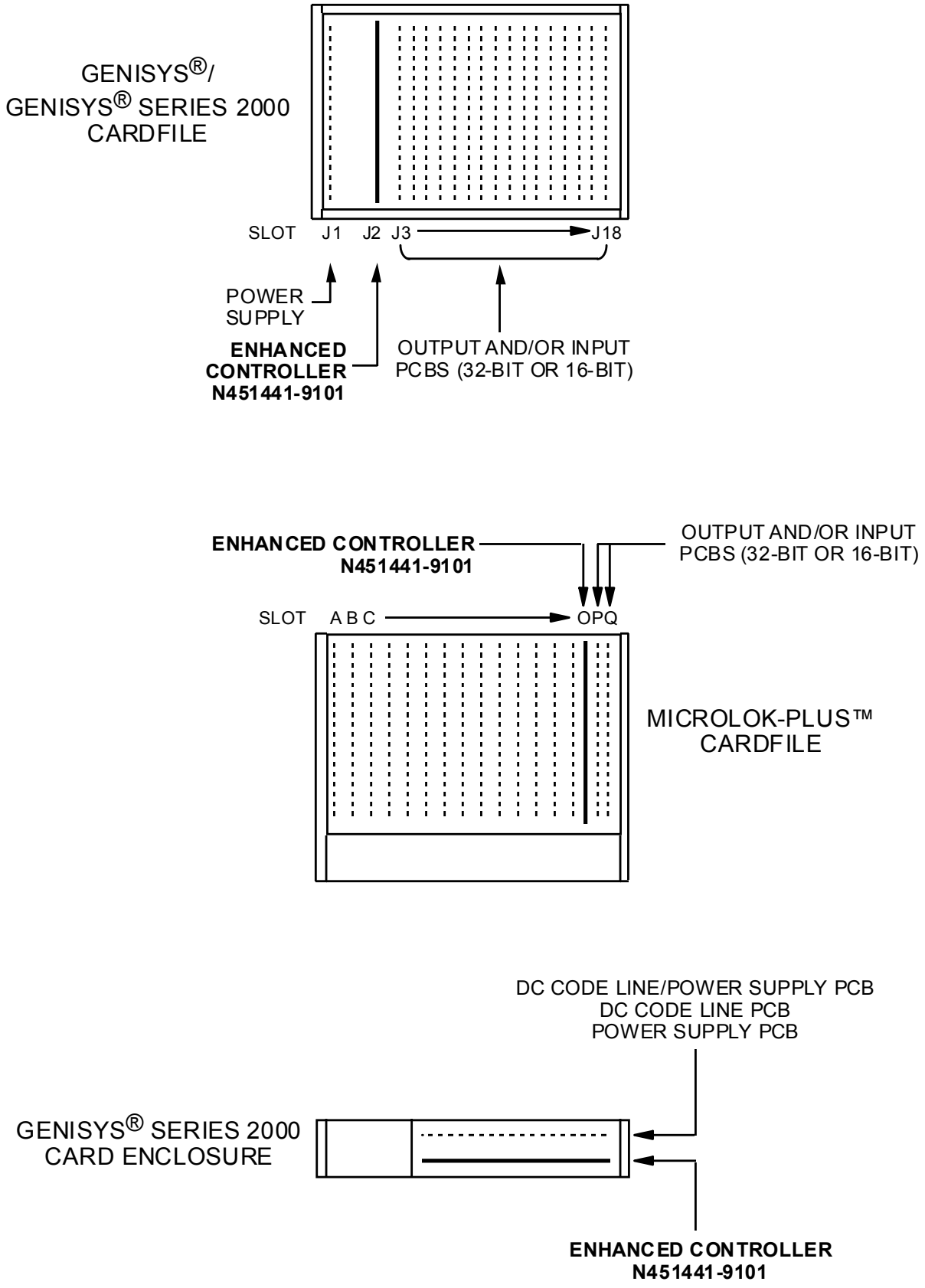


Figure 2-3. Enhanced Controller PCB Installation

2.3.4 Serial and Parallel Communications Interfaces

2.3.4.1 General

Figure 2-4 summarizes the serial and parallel communications interfaces to the Enhanced Controller board for the system applications covered in this manual. Three serial communications ports on the Enhanced Controller reside on the "A" connector. These ports include:

A. Universal synchronous/asynchronous Slave port for communications with a remote Master unit

B. Asynchronous-only Master port for communications with a remote Slave Unit

C. Universal spare port (not used)

The asynchronous 9-pin port on the PCB front edge is only used for on-site set-up and diagnostics. Refer to Section 2.3.4.8 for wiring of this port.

The Universal Slave serial interface port supports both synchronous and asynchronous interfaces and is an RS-422 compatible implementation of RS-423. All inputs are balanced differential inputs, while all outputs are unbalanced and referenced to signal common. This allows connection to external devices implementing standard RS-232, RS-422 or RS-423 interfaces. The Master serial interface and set-up/diagnostics ports only support asynchronous serial interfaces and RS-232/423 electrical compatibility.

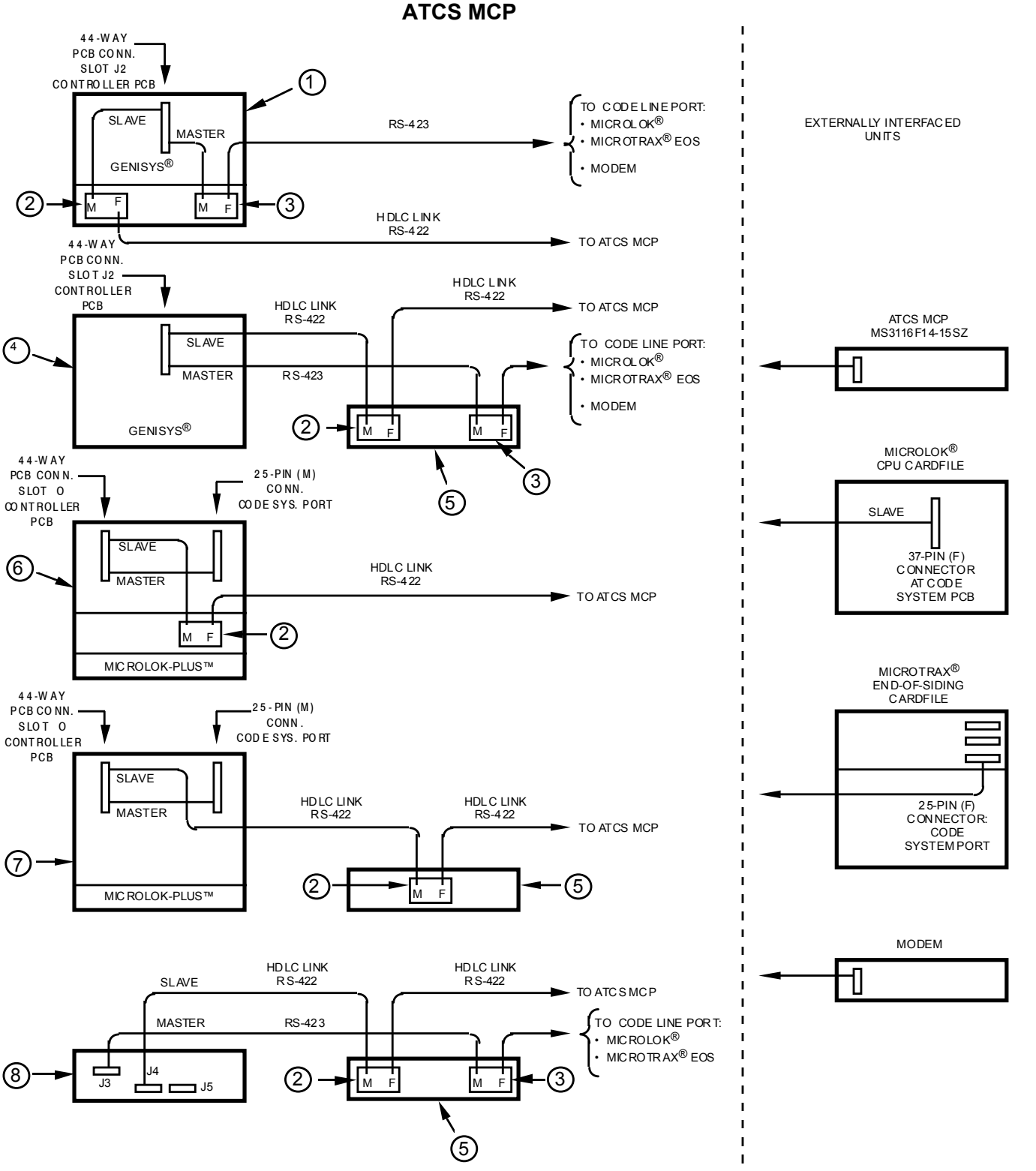
Physically, the serial ports on the Enhanced Controller are connected with a 44-way cable connector when the board is installed in a GENISYS® or MICROLOK-PLUS™ cardfile. When the board is installed in the GENISYS® Series 2000 Card Enclosure, the serial ports are externally connected through plugs J3, J4 and J5 (25-pin "D" type) on the rear of the Card Enclosure, which shares a motherboard bus with the Enhanced Controller. Shielded cable is used in all interfaces to minimize induced noise. Twisted pair wiring is also employed in the ATCS MCP interface to take full advantage of the additional noise immunity inherent in RS-422 balanced signal circuits.

NOTE

The Enhanced Controller PCB is not equipped with a TTL-compatible serial communications port, as is provided on the on -5602 Controller PCB.

NOTE

Use of the GENISYS® Series 2000 Surge Suppressor/Serial Interface Panel is optional, but strongly recommended for any installation where transient voltages (e.g. lightning induced) could damage circuits in the Enhanced Controller PCB.



1 GENISYS® CARDFILE WITH BUILT-IN SURGE PCB PANEL

2 SURGE SUPPR./SERIAL INTERFACE PCB N451807-8902

3 SURGE SUPPR./SERIAL INTERFACE PCB N451807-8901

4 GENISYS® CARDFILE WITHOUT BUILT-IN SURGE PCB PANEL

5 GENISYS® 2000 SURGE PCB MOUNTING PANEL N451892-1401

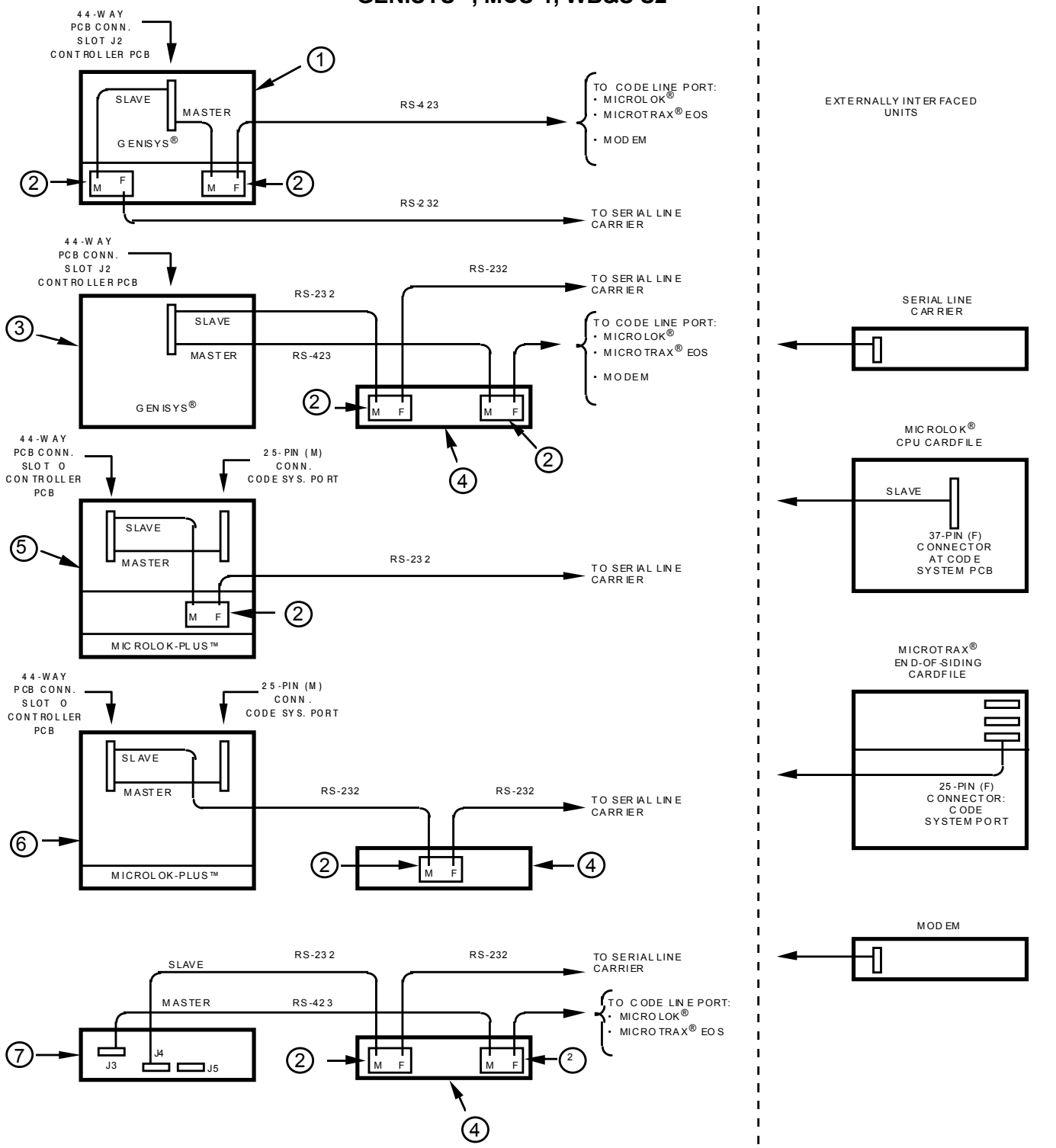
6 MICROLOK-PLUS™ CARDFILE WITH BUILT-IN SURGE PCB PANEL

7 MICROLOK-PLUS™ CARDFILE WITHOUT BUILT-IN SURGE PCB PANEL

8 GENISYS® 2000 CARD ENCLOSURE

Figure 2-4. Basic Serial Communications Links with ATCS MCP Interface

GENISYS®, MCS-1, WB&S S2



1 GENISYS® CARDFILE WITH BUILT-IN SURGE PCB PANEL

2 SURGE SUPPR/SERIAL INTERFACE PCB N451807-8901

3 GENISYS® CARDFILE WITHOUT BUILT-IN SURGE PCB PANEL

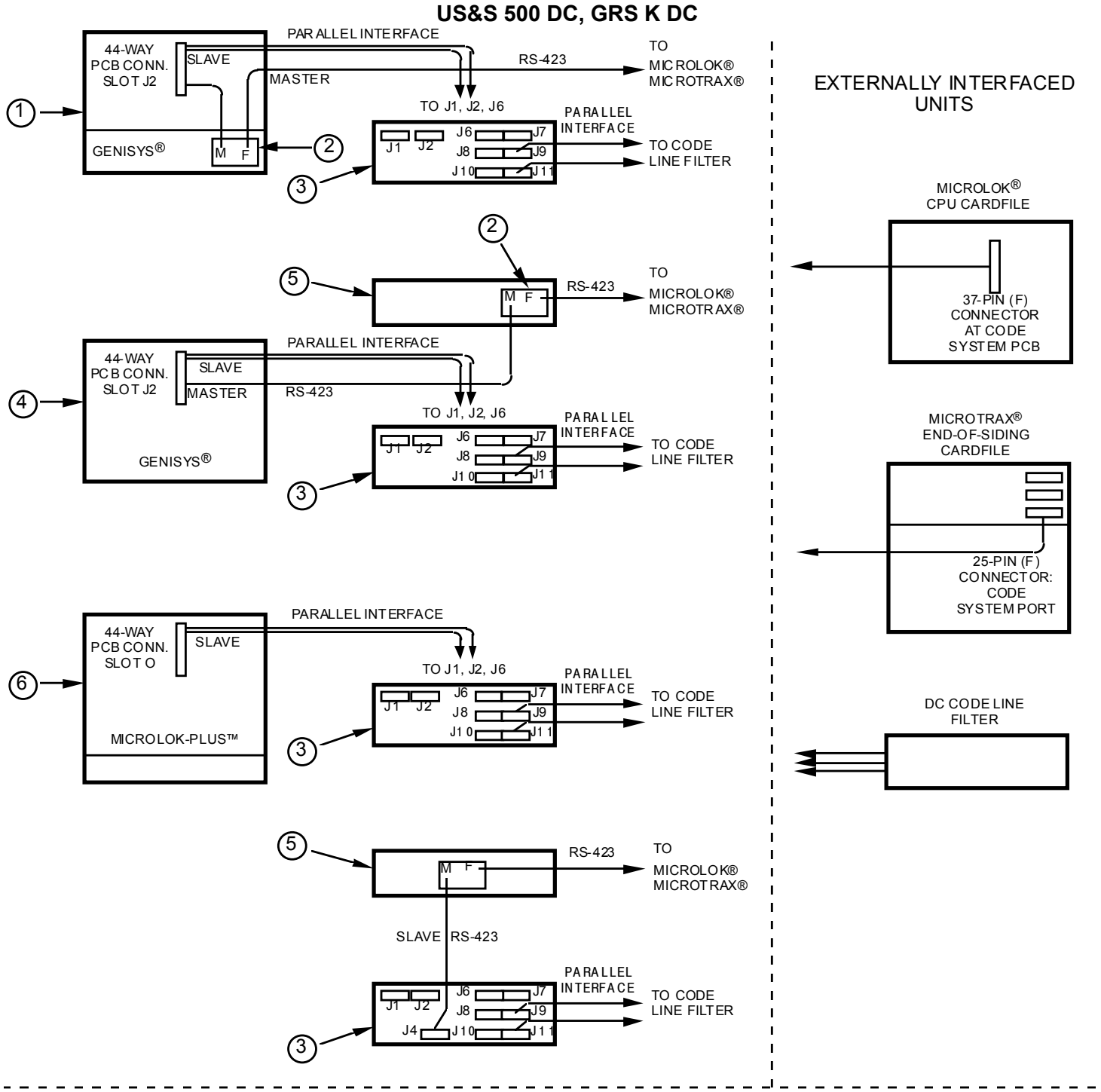
4 GENISYS® 2000 SURGE PCB MOUNTING PANEL N451892-1401

5 MICROLOK-PLUS™ CARDFILE WITH BUILT-IN SURGE PCB PANEL

6 MICROLOK-PLUS™ CARDFILE WITHOUT BUILT-IN SURGE PCB PANEL

7 GENISYS® 2000 CARD ENCLOSURE

Figure 2-5. Basic Serial Communications Links with Serial Code Line Interface



1 GENISYS® CARDFILE WITH BUILT-IN SURGE PCB PANEL

2 SURGE SUPPR./SERIAL INTERFACE PCB N451807-8901

3 GENISYS® SERIES 2000 CARD ENCLOSURE (INTERFACE MODULE) N451891-0102

4 GENISYS® CARDFILE WITHOUT BUILT-IN SURGE PCB PANEL

5 GENISYS® SERIES 2000 SURGE PCB MOUNTING PANEL N451892-1401

6 MICROLOK-PLUS™ CARDFILE (BUILT-IN SURGE PCB PANEL NOT REQUIRED)

Figure 2-6. Basic Serial Communications Links with DC Code Line Interface

ALL APPLICATIONS

Refer to Section 2.4.2, Procedure Using Board Switches and Alpha-Numeric LEDs, for serial communications set up instructions using the switches and alpha-numeric display, and Section 2.4.3, Procedure Using Portable PC, for set-up via a PC. Refer to SM-6700A, Genisys Series 2000 Application Logic Programming, for serial communications programming in the Application software.

Parallel interface lines to the Enhanced Controller also reside on the "A" connector and are used strictly for DC code line applications. These include four output lines, four input line and dc voltage lines of +5V, +12V, -12V and 0V. Refer to following section for parallel line pinout locations.

2.3.4.2 PCB Connector "A" Pinout Listing (Serial and Parallel Ports)

Table 2-1. Enhanced Controller PCB Connector "A" Pinout Listing

Pin No.	Description	Pin No.	Description
1	S2RXD- (Spare Receive Data "-")	A	S2COM (Spare Common: 0 volts)
2	S2DCD- (Spare Data Carrier Detect "-")	B	S2RXC- (Spare Receive Clock "-")
3	S1TXC- (Slave Transmit Clock "-")	C	S1TXC+ (Slave Transmit Clock "+")
4	S1RTS (Slave Request to Send)	D	S1DTR (Slave Data Terminal Ready)
5	S1TXD (Slave Transmit Data)	E	S1TXC (Slave Transmit Clock: Output)
6	S1COM (Slave Common: 0 volts)	F	S2TXC (Spare Xmit Clock: Output)** S2TXC- (Spare Xmit Clock "-": Input)**
7	S2DTR (Spare Data Terminal Ready)	H	MDTR (Master Data Terminal Ready)
8	S2TXD (Spare Transmit Data)	J	S2RTS (Spare Request to Send)
9	S1DCD- (Slave Data Carrier Detect "-")	K	S1DCD+ (Slave Data Carrier Detect "+")
10	S1RXC- (Slave Receive Clock "-")	L	S1RXC+ (Slave Receive Clock "+")
11	S1CTS- (Slave Clear to Send "-")	M	S1CTS+ (Slave Clear to Send "+")
12	S1RXD- (Slave Receive Data "-")	N	S1RXD+ (Slave Receive Data "+")
13	POUT1 (Parallel Out 1)*	P	POUT2 (Parallel Out 2)*
14	POUT2 (Parallel Out 2)*	R	POUT4 (Parallel Out 4)*
15	PIN1 (Parallel In 1)*	S	PIN2 (Parallel In 2)*
16	PIN3 (Parallel In 3)*	T	PIN4 (Parallel In 4)*
17	+12V (+12 Volts dc)*	U	+12V (+12 volts dc)
18	MTXD (Master Transmit Data)	V	MRTS (Master Request to Send)
19	0V (0 volts dc)*	W	MCOM (Master Common: 0 volts)
20	-12V (-12 volts dc)*	X	-12V (-12 volts dc)
21	MRXD (Master Receive Data)	Y	MDCD (Master Data Carrier Detect)
22	+5V (+5 volts dc)*	Z	+5V (+5 volts dc)

Notes: * Connections to Code Line Interface board
**Output or input selected with jumper JP5 on controller board
S1 = Slave Port: RS-423 (RS-422 compatible)
S2 = Spare Port: RS-232D compatible
M = Master Port: RS-232D compatible

ALL APPLICATIONS

2.3.4.3 PCB Connector "A" Signal Line Descriptions

Table 2-2. Describes all individual serial and parallel signal lines on all "A" connector edge ports.

Table 2-2. Enhanced Controller PCB Signal Line Descriptions (Serial and Parallel) - Connector "A"

Signal Name	Signal Direction	Port(s)	Description
TXD (Transmit Data)	Output	Slave Master Spare	Passes serial data to connected device.
RXD (Receive Data)	Input	Slave Master Spare	Accepts serial data from connected device.
RTS (Request to Send)	Output	Slave Master Spare	Frames transmitted message. Typically used to turn on data carrier at start of transmitted message, turn off carrier and end of this message.
CTS (Clear to Send)	Input	Slave	Indicates the serial link is stable and ready to accept transmitted data. Typically asserted in response to RTS by the serial link after fixed delay.
DCD (Data carrier detect)	Input	Slave Master Spare	Indicates serial link (carrying incoming data) is active and stable. Connected unit is about to send or is sending data.
TXC (Transmit Clock)	Input or Output	Slave Spare	Clock signal to which transmitted data is synchronized. Transmitted data is valid on negative-going transition of clock signal. Transmitted data also in transition on positive-going transition of clock signal. Slave port may accept or generate TXC based on position of jumpers JP2 and JP4. TXC only used when transmitting serial data in synchronous mode.

RXC (Receive Clock)	Input	Slave Spare	Clock signal, provided by source of received data, to which received data is synchronized. Received data expected to be valid on negative-going transition of received clock. Received data also expected to be in transition on positive-going transition of received clock. RXC only used when receiving serial data in synchronous mode.
DTR (Data Terminal Ready)	Output	Slave Master Spare	Slave: Asserted to enable the connected data modem. When not asserted, modem transmit oscillator is disabled. DTR only used by WB&S S2 Executive software. Master, Spare: Not used.

2.3.4.4 Detailed Serial Link Diagrams

The following tabulation summarizes detailed serial link diagrams in this section:

Fig. No.	Page No.	Description/Comments
2-7	2-20	**Serial Port Wiring with ATCS MCP Interface - GENISYS® Cardfile** • Enhanced Controller Slave port interface to MCP • Master port interfaces to modem or external US&S interlocking controller.
2-8	2-21	**Serial Port Wiring with ATCS MCP Interface - MICROLOK-PLUS™ Cardfile** • Enhanced Controller Slave port interface to MCP • Master port interfaces to modem or to MICROLOK-PLUS™ code system port on same cardfile. (Vital section of MICROLOK-PLUS™ cardfile functions as interlocking controller.)
2-9	2-22	**Serial Port Wiring with ATCS MCP Interface - GENISYS® Series 2000 Card Enclosure** • Covers Enhanced Controller Slave port interface to MCP • Master port interface to external US&S interlocking controller.
2-10	2-23	**Serial Port Wiring with Serial Code Line Interface - GENISYS® Cardfile** • Enhanced Controller Slave port interface to serial code line carrier • Master port interfaces to modem or external US&S interlocking controller.
2-11	2-24	**Serial Port Wiring with Serial Code Line Interface - MICROLOK-PLUS™ Cardfile** • Enhanced Controller Slave port interface to serial code line carrier • Master port interfaces to modem or to MICROLOK-PLUS™ code system port on same cardfile. (Vital section of MICROLOK-PLUS™ cardfile functions as interlocking controller.)
2-12	2-25	**Serial Port Wiring with Serial Code Line Interface - GENISYS® Series 2000 Card Enclosure** • Enhanced Controller Slave port interface to serial code line carrier • Master port interface to external US&S interlocking controller.

ATCS MCP

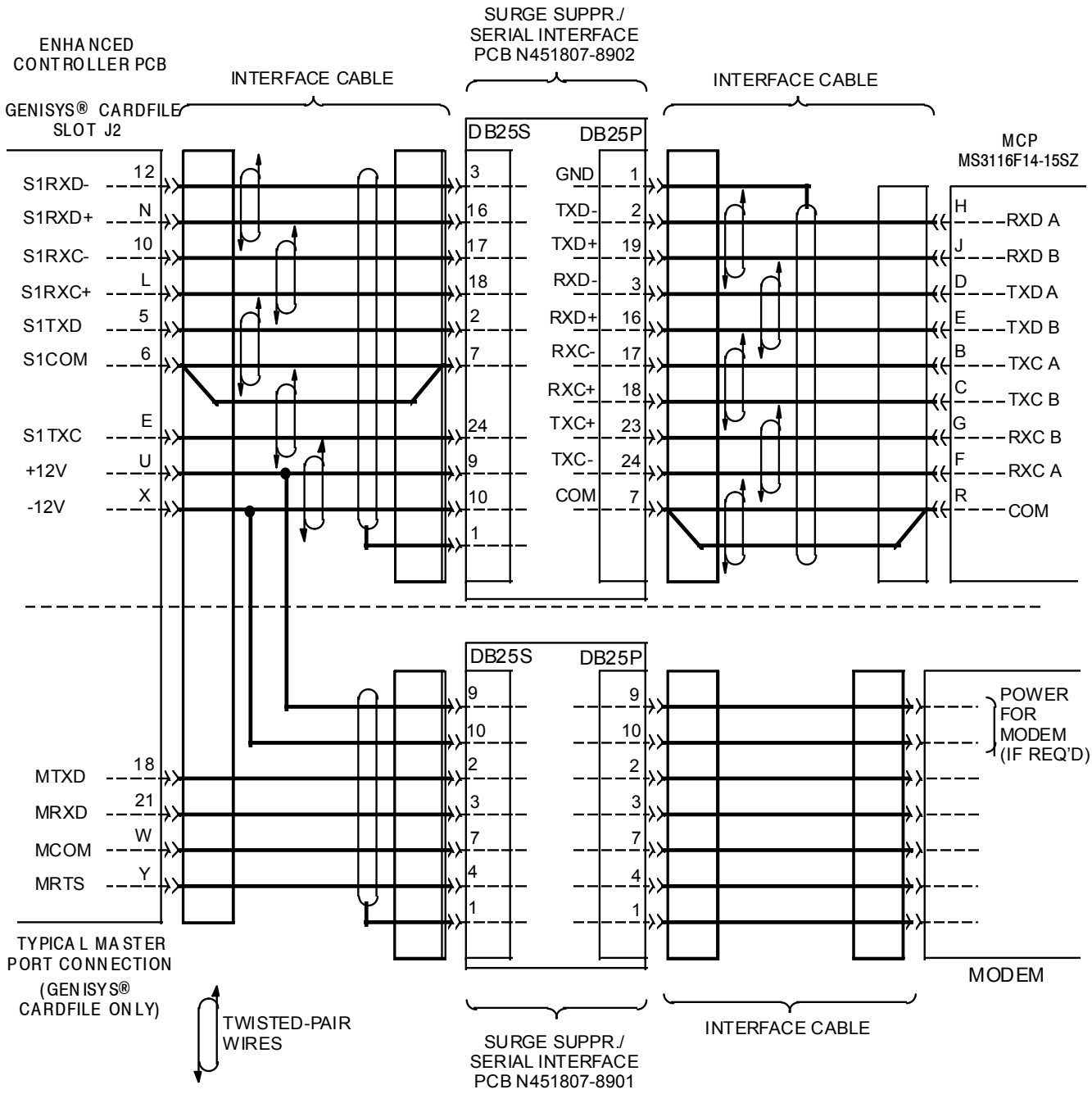


Figure 2-7. Serial Port Wiring with ATCS MCP Interface - GENISYS® Cardfile

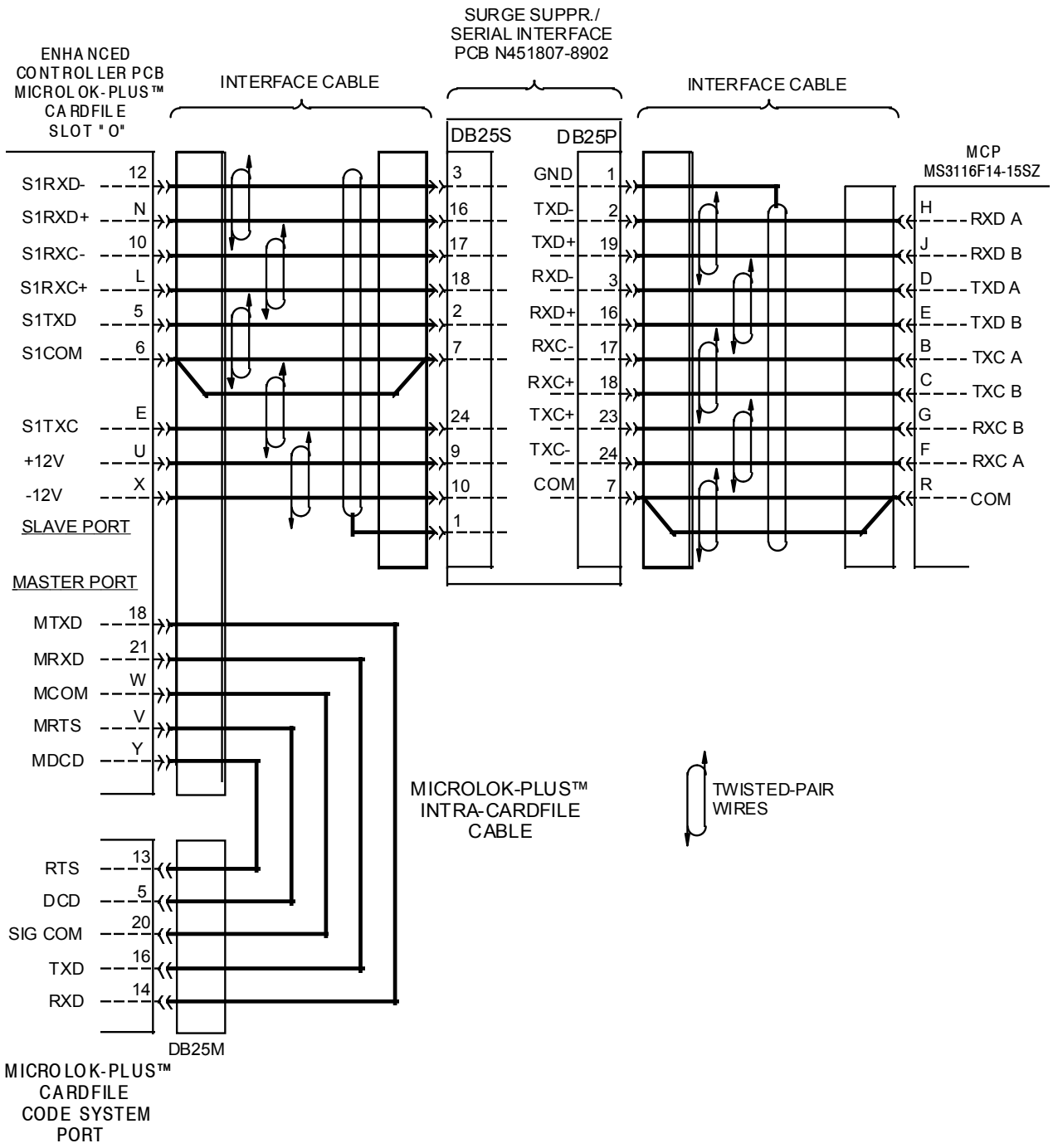


Figure 2-8. Serial Port Wiring with ATCS MCP Interface - MICROLOK-PLUS™ Cardfile

ATCS MCP

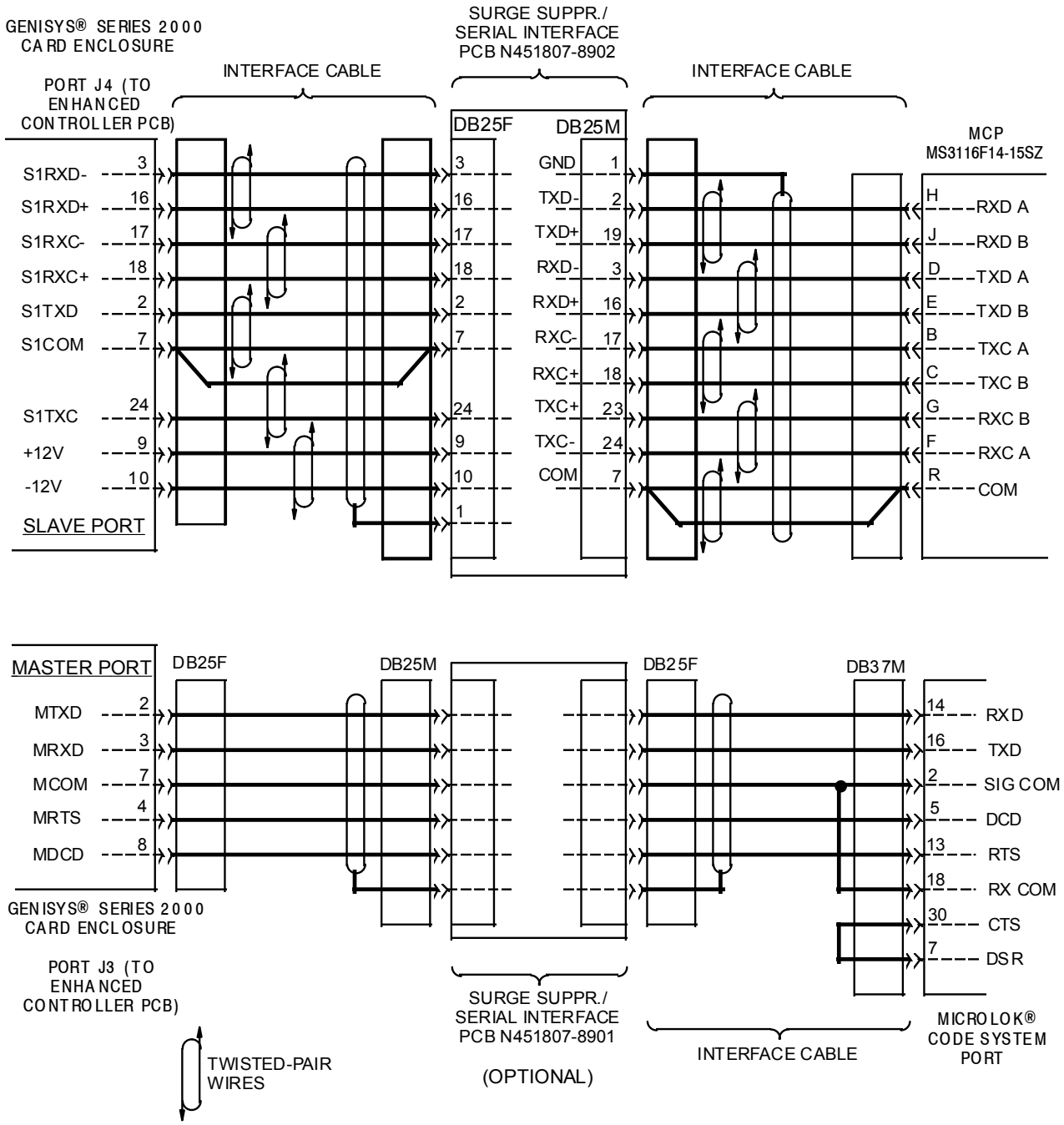


Figure 2-9. Serial Port Wiring with ATCS MCP Interface - GENISYS® Series 2000 Card Enclosure

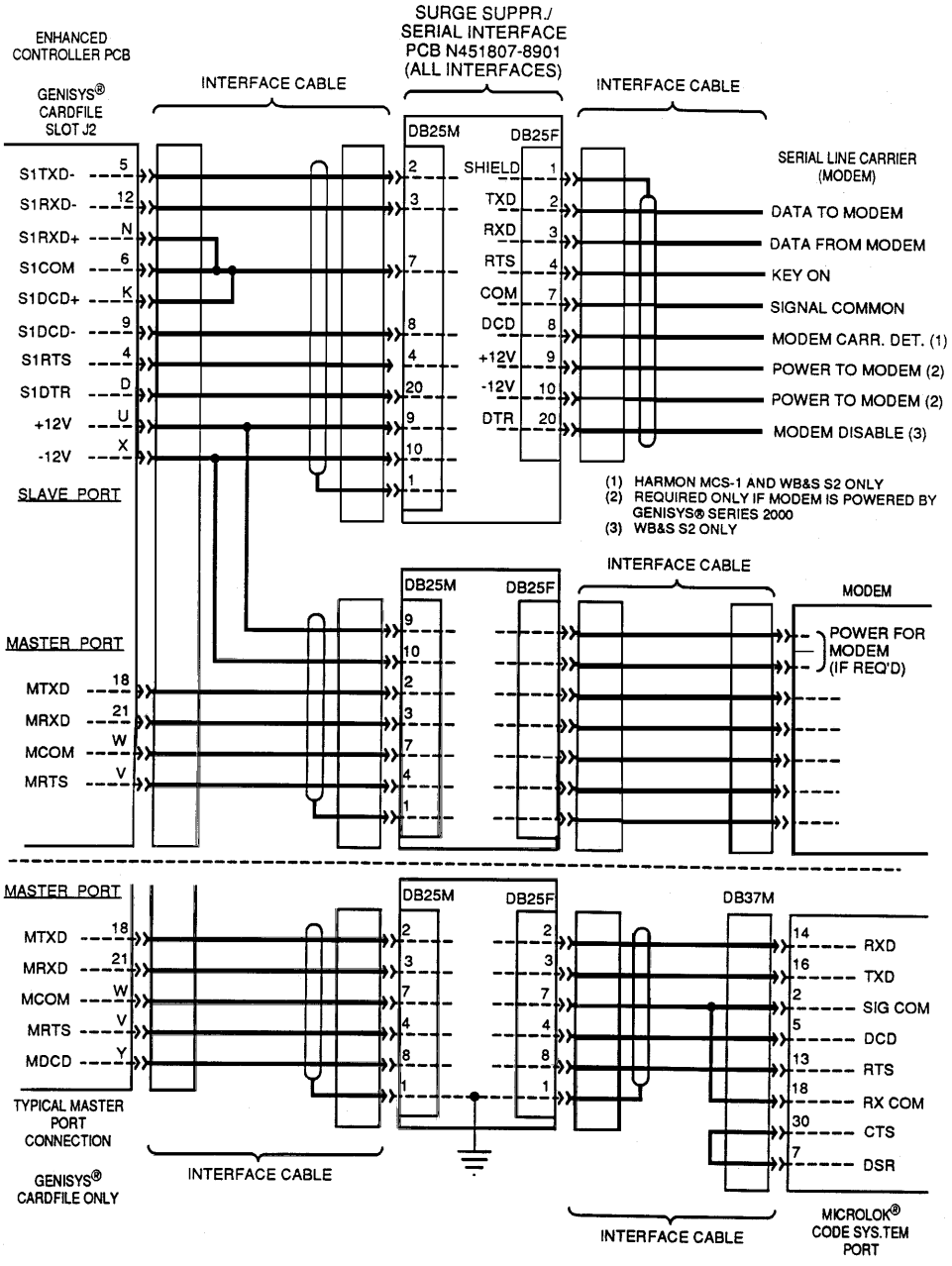


Figure 2-10. Serial Port Wiring with Serial Code Line Interface - GENISYS® Cardfile

GENISYS®, MCS-1, WB&S S2

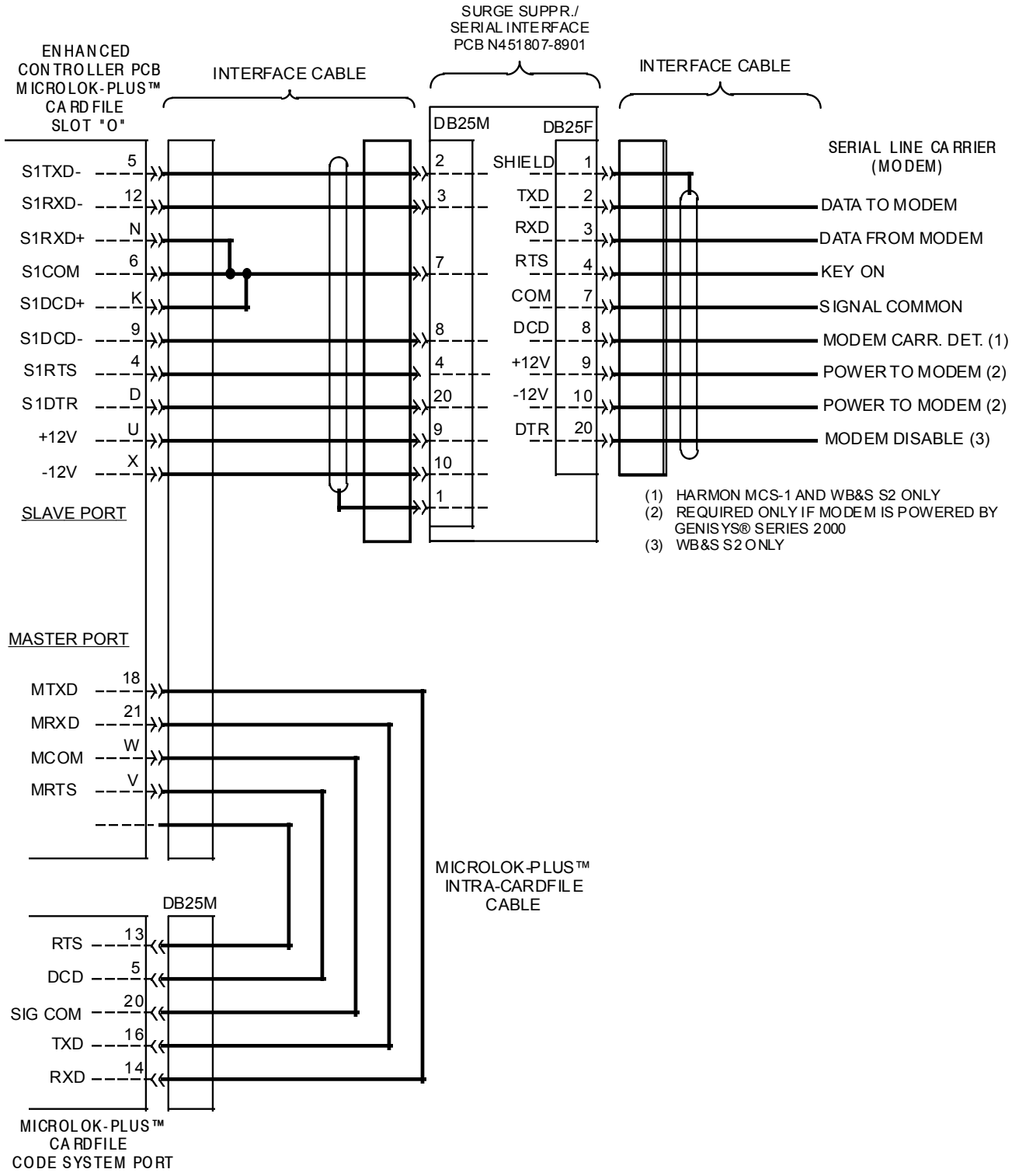


Figure 2-11. Serial Port Wiring with Serial Code Line Interface - MICROLOK-PLUS™ Cardfile

GENISYS®, MCS-1, WB&S S2

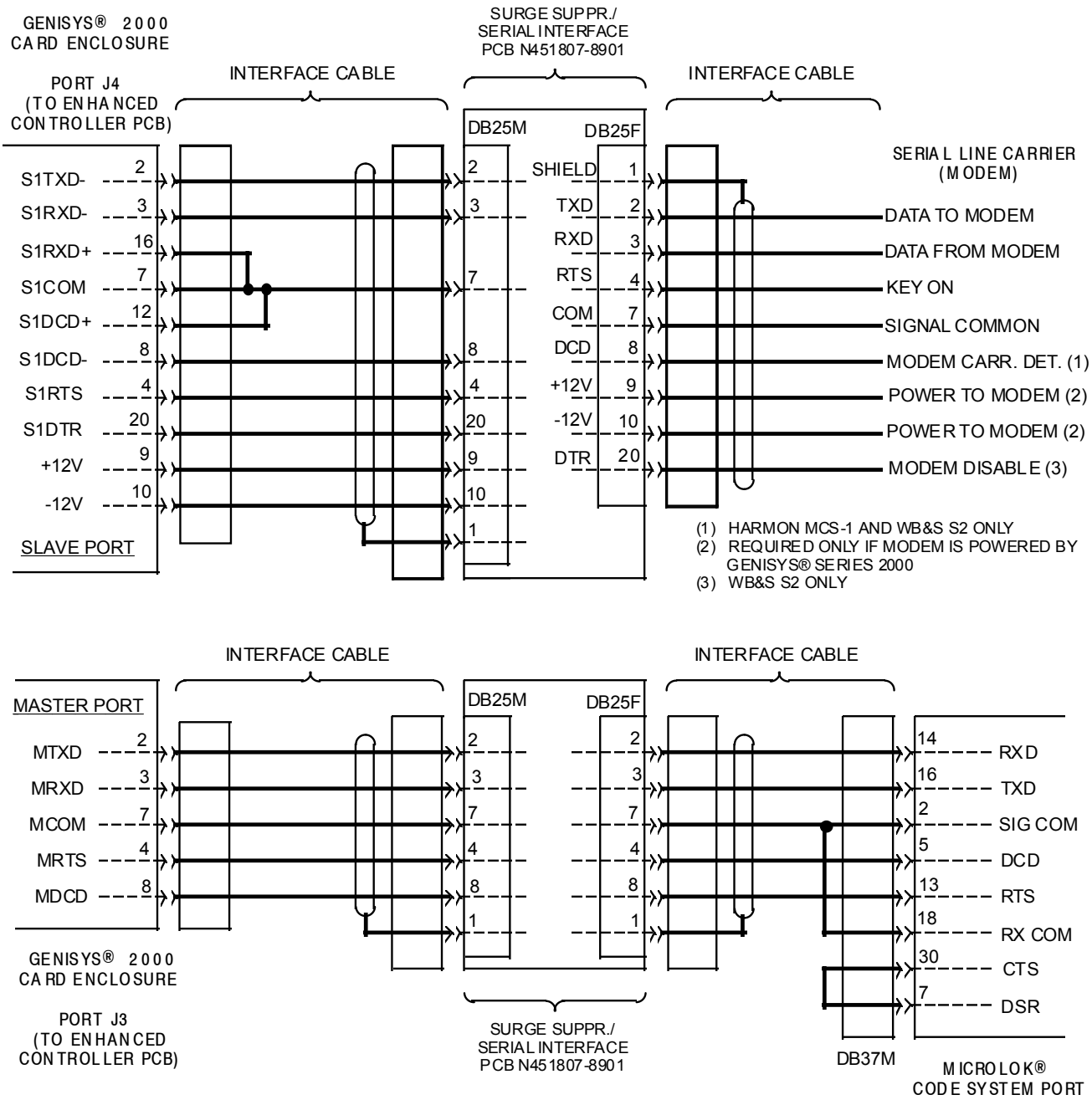


Figure 2-12. Serial Port Wiring with Serial Code Line Interface - GENISYS® Series 2000 Card Enclosure

US&S 500 DC, GRS K DC

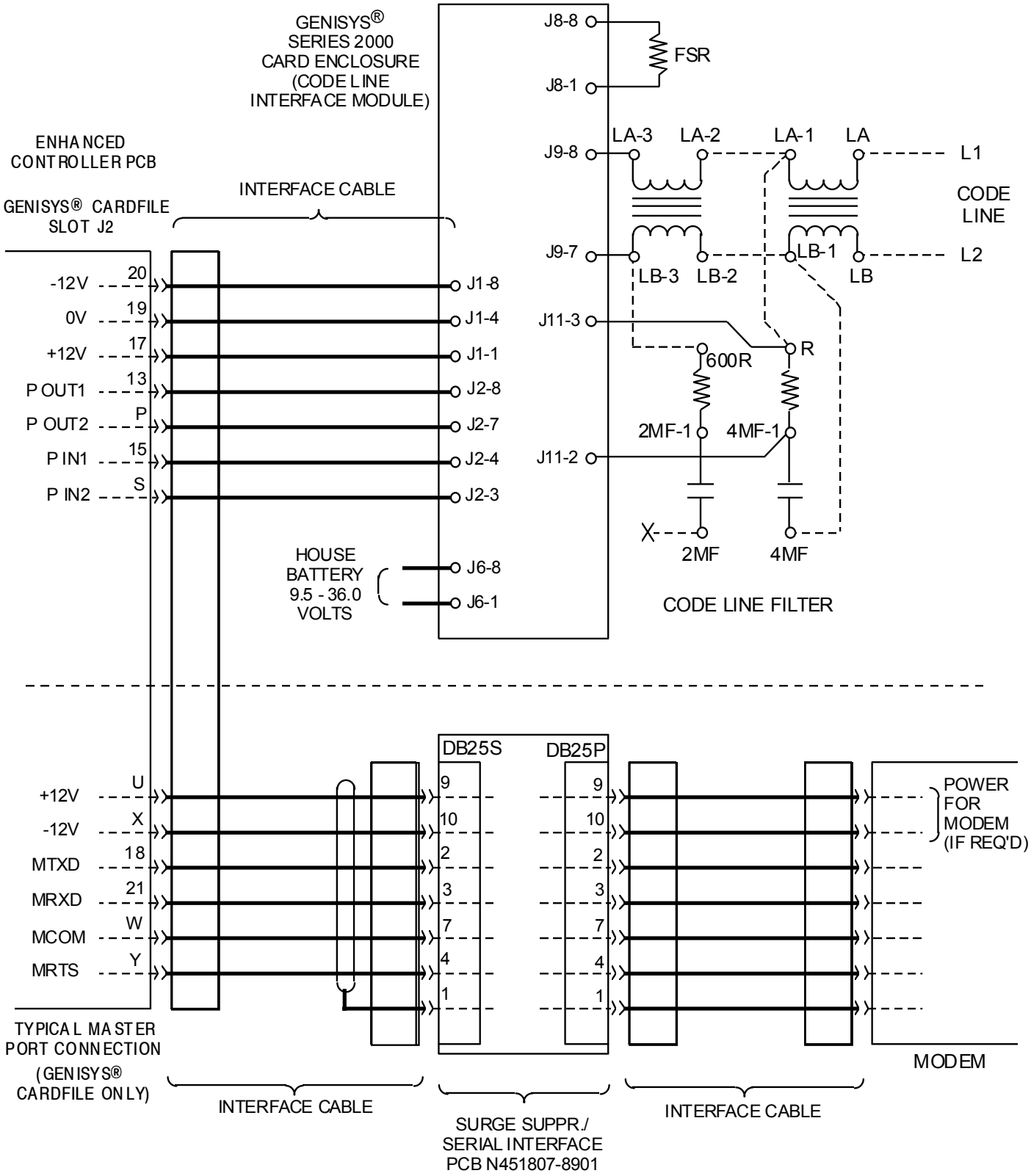


Figure 2-13. Parallel and Serial Port Wiring with DC Code Line Interface GENISYS® Cardfile

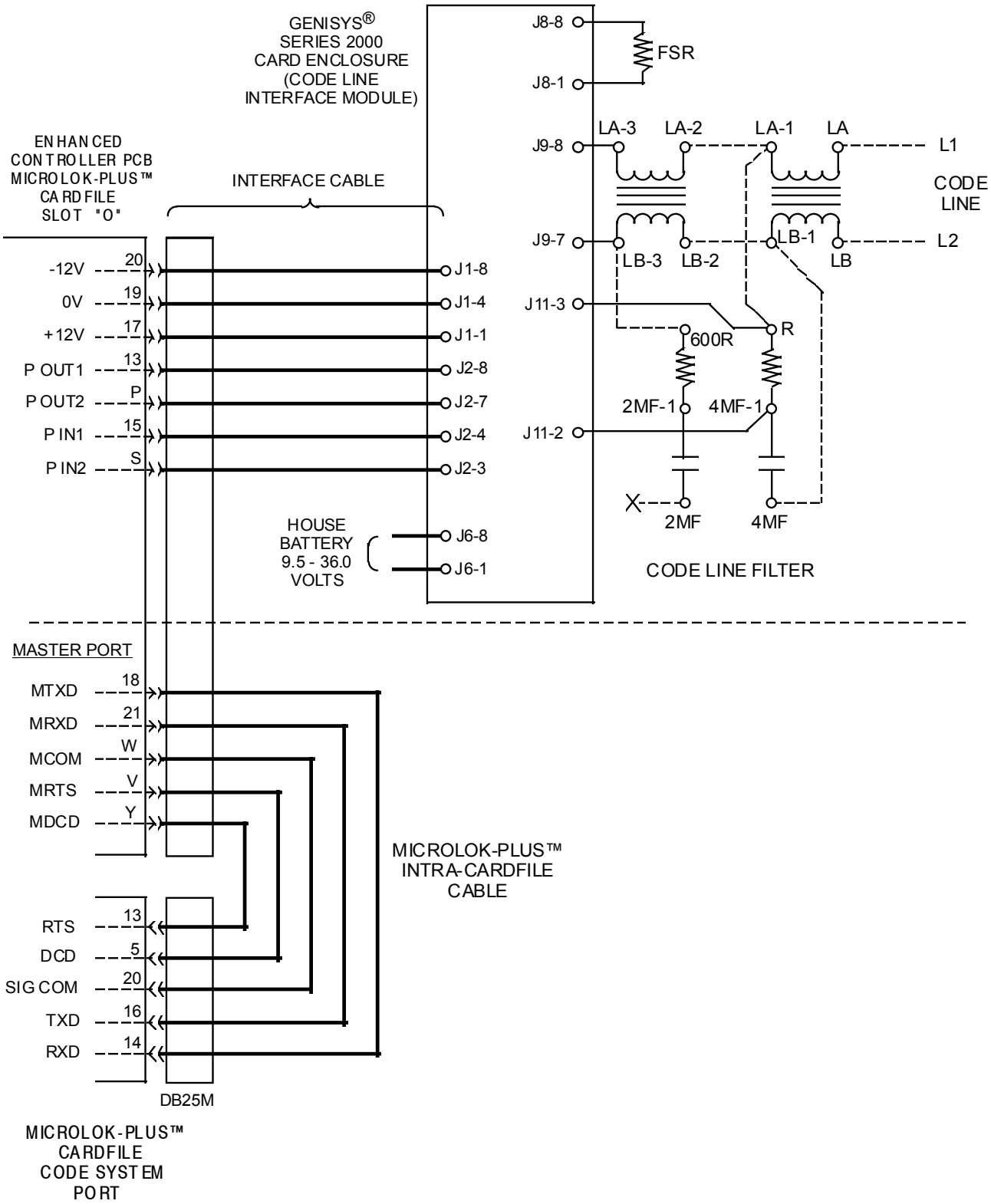


Figure 2-14. Parallel and Serial Port Wiring with DC Code Line Interface MICROLOK-PLUS™ Cardfile

US&S 500 DC, GRS K DC

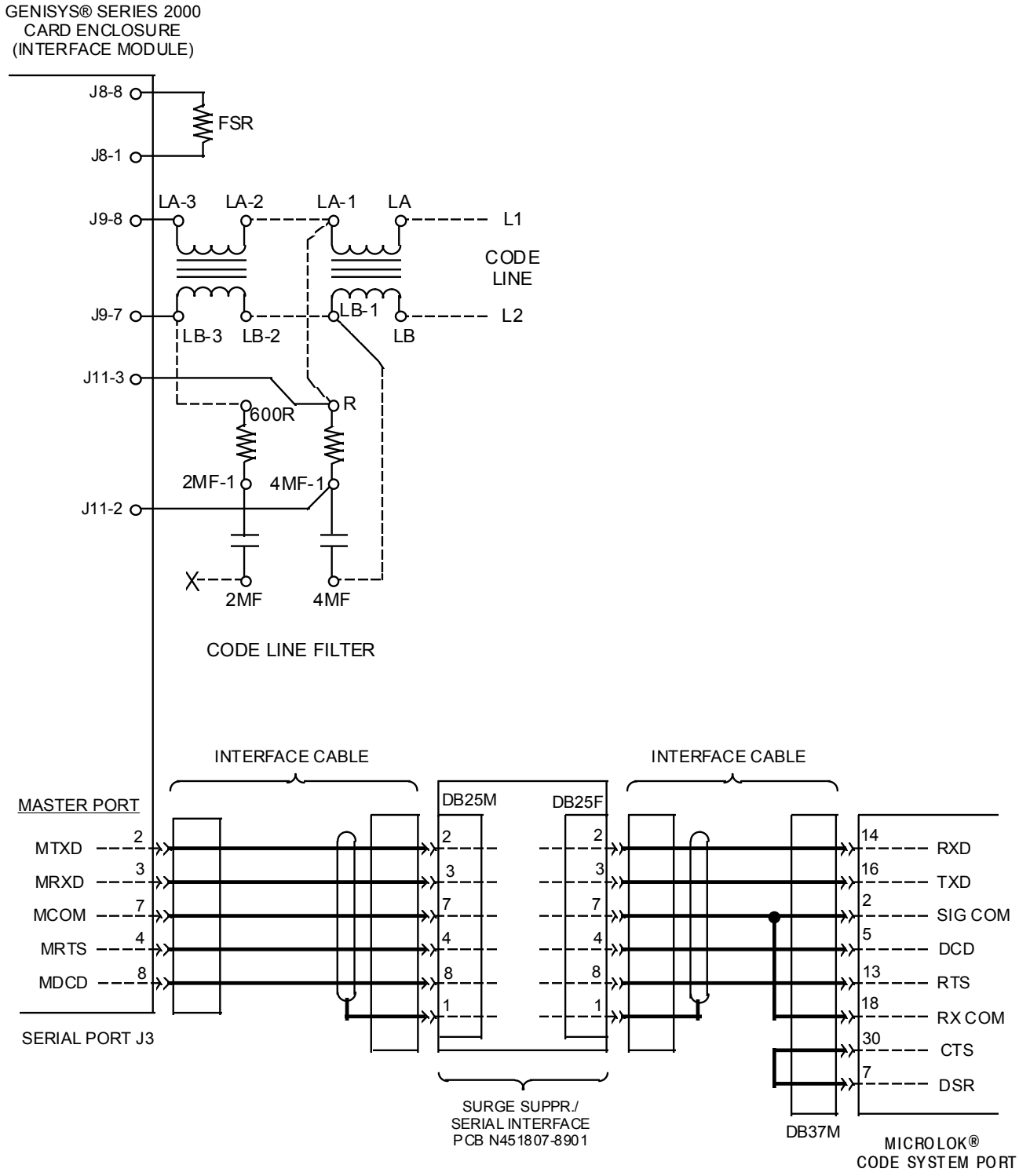


Figure 2-15. Parallel and Serial Port Wiring with DC Code Line Interface GENISYS® Series 2000 Card Enclosure

2.3.4.5 Serial Interface to Portable PC

The PC serial port is a standard 9-pin, IBM compatible interface that uses RS-423 (RS-232C) signals. Operating mode is asynchronous only. Baud rates range from 150 BPS to 19,200 BPS (default: 2400 BPS). To select the baud rate on the Enhanced Controller PCB, use the switch/LED field configuration procedure for the type of Executive software installed on the board (refer to section 2.5.2). Table 2-3 lists pinouts. Figure 2-16 shows wiring options.

Table 2-3. Enhanced Controller PCB 9-Pin Port Pinout Listing

Pin No.	Description
1	DCD: Data Carrier Detect
2	RXD: Received Data
3	TXD: Transmitted Data
4	DTR: Data Terminal Ready
5	COM: Signal Common
6	NC: (No connection)
7	RTS: Request to Send
8	NC: (No connection)
9	NC: (No connection)

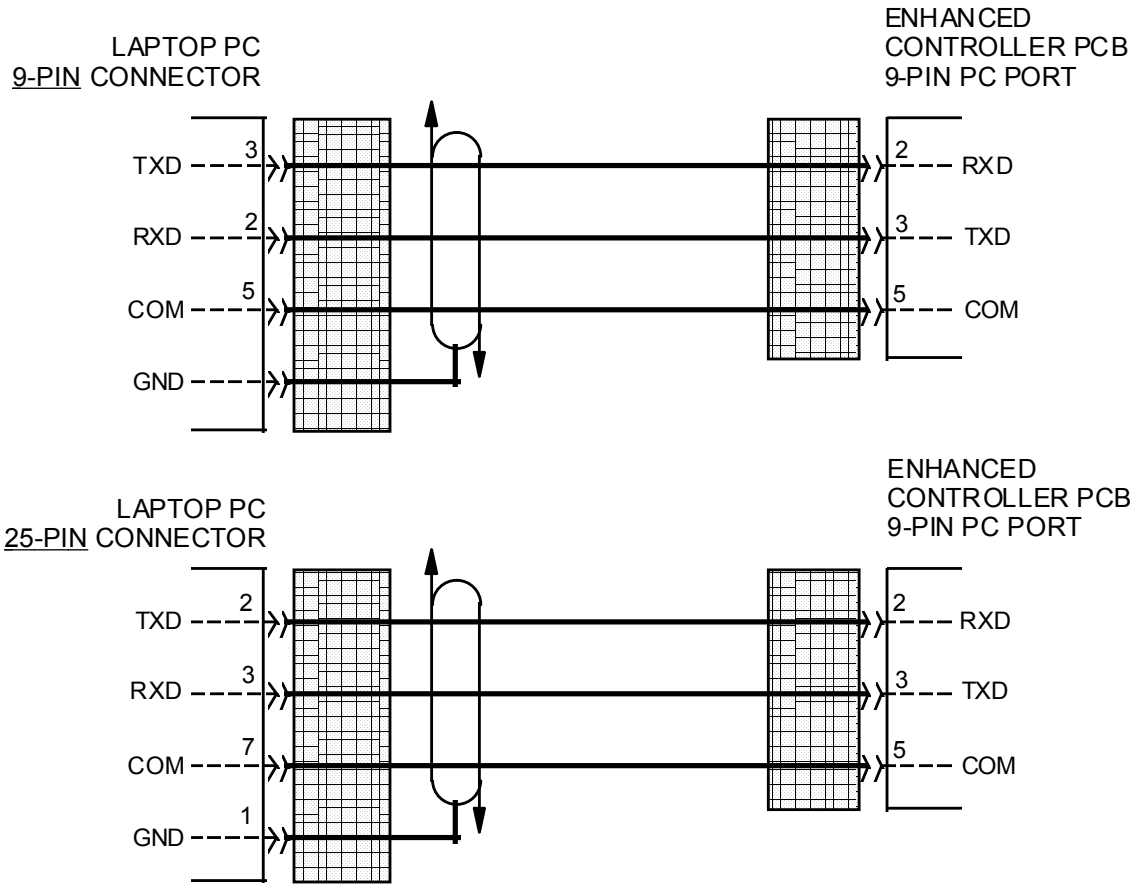


Figure 2-16. Enhanced Controller Interface to Portable PC

ALL APPLICATIONS

2.4 FIELD CONFIGURATION PROGRAMMING

2.4.1 Introduction

This section describes how to select various field configuration values unique to each Enhanced Controller installation, using the board's front edge switches and alpha-numeric display, or a PC plugged into the front edge 9-pin port. Field configuration values may also be defined in the Application software (refer to SM-6700A, Genisys® Series 2000 Application Logic Programming for procedures). Field configuration values are entered according to the type Executive software installed on the Enhanced Controller (e.g. ATCS MCP, GENISYS®). These values are stored in field configuration software EEPROM U15.

Most (but not all) configuration operations can be performed using the on-board configuration process. The process allows most parameters to be viewed or changed, however it is somewhat more cumbersome than the DTOOL utility, and is intended for emergency field use.

Refer to section 2.4.2, Procedure Using Board Switches and Alpha-Numeric LEDS's, for the switch/LED field configuration procedure.

The PC-based field configuration procedure is part of the "DTOOL" program utility, which performs diagnostic as well as set-up operations. This procedure controls a greater range of field configuration parameters than the on-board switch procedure. (These additional parameters are also controllable in the Application software.) Refer to section 2.4.3, Procedure Using Portable PC, for the PC-based set-up procedures.

CAUTION

Before setting any field configuration value in the Genisys® Series 2000 Enhanced controller board, consult Service Manual 6300B, Genisys/Microlok Plus Installation/Field Maintenance, for recommendations on optimum settings. If these recommendations are not followed the system could operate unreliably.

The latest revision of the original GENISYS® controller Executive program obtains its configuration from parameters programmed in the application EPROM, and from discrete configuration switches on the Enhanced Controller board. Configuration parameters not set in the application program (which are alternately assigned to switches) may be set by changing the on-board configuration switches. Configuration parameters explicitly set in the Application program may only be changed by changing the Application program.

The resulting composite of configuration parameters (Application program, on-board switch, and DTOOL-defined) is stored in non-volatile memory (serial EEPROM), from which it is reloaded each time the controller PCB is reset.

When Executive and Application PROMs are first installed on a new Enhanced Controller board and the board is powered up:

A. Checksums of the Application and Executive PROM sets are compared to checksums stored in the Enhanced Controller's non-volatile configuration memory.

B. If the checksums do not match those in configuration memory, or if the memory is invalid, the unit configuration is rebuilt.

C. Values to be stored in the rebuilt configuration memory are obtained as follows:

1. First from values placed in the Application program by the user.

2. Second from Application program standard default values (placed by GENISYS® Series 2000 compiler) where user values are not specified.

3. Last from Executive program standard default values where Application program values (user or default) are not specified.

D. These default values, along with Executive and Application program checksums, are automatically written to the non-volatile configuration memory when the new Enhanced Controller/program is first initialized.

E. This valid product configuration will be loaded in any time the Enhanced Controller is powered up or reset.

F. Once valid, the configuration memory can be changed either using the on-board switches or DTOOL utility.

G. The modified configuration can be stored, if desired, in the non-volatile configuration memory, where it becomes the permament configuration of the Enhanced Controller. (Data stored in the serial EPROM is highly secure.)

The permanent configuration is a composite of values selected by the application programmer, the GENISYS® Series 2000 compiler, the Executive program and the field user (via the on-board switches). This arrangement is designed to simplify Enhanced Controller installation by reducing the need to re-program Application PROMs when unexpected changes to the site application are encountered. After successful completion of an installation, configuration data in the Application EPROMs may be updated to reflect the final, permanent configuration. Or, the permanent configuration in the EPROM can be used indefinitely.

The permanent configuration for an Enhanced Controller is destroyed and replaced with default configuration when:

A. Executive or Application program PROM sets are replaced with PROM sets having different checksums.

B. The “Load Default” (**LD**) command is issued, followed by the “Write” (**WR**) command (from the on-board switches or DTOOL utility).

C. The permament configuration is determined to be invalid.

ALL APPLICATIONS

2.4.2 On-Board Configuration Procedure

2.4.2.1 Introduction

The on-board field configuration procedure uses toggle switch SW1 ("Select"), pushbutton switch SW2 ("Execute") and the 4-character alpha-numeric display.

1. A given parameter is selected by pressing switch SW1 downward when the Enhanced Controller is installed in a GENISYS® or MICROLOK-PLUS™ cardfile, and to the right when the board is installed in the GENISYS® Series 2000 Card Enclosure.

2. Each time this switch is pressed, a 2-character code or "mnemonic" appears in the alpha-numeric display. This represents a specific parameter such as Slave port baud rate or Master port key-on delay.

3. Once a parameter is selected, it is entered by pressing switch SW2 (execute). At this point, the current value for that parameter is displayed in the remaining part of the alpha-numeric display.

4. Pressing toggle switch SW1 advances the display through all possible values in a continuous loop.

5. When the desired parameter value is reached, the SW2 is pushed. This action stores the value in the active configuration in volatile memory.

6. If a given parameter is not entered within 30 seconds of call-up, the alpha-numeric display goes dark. To restore the display, press toggle switch SW1 downward to recycle the display.

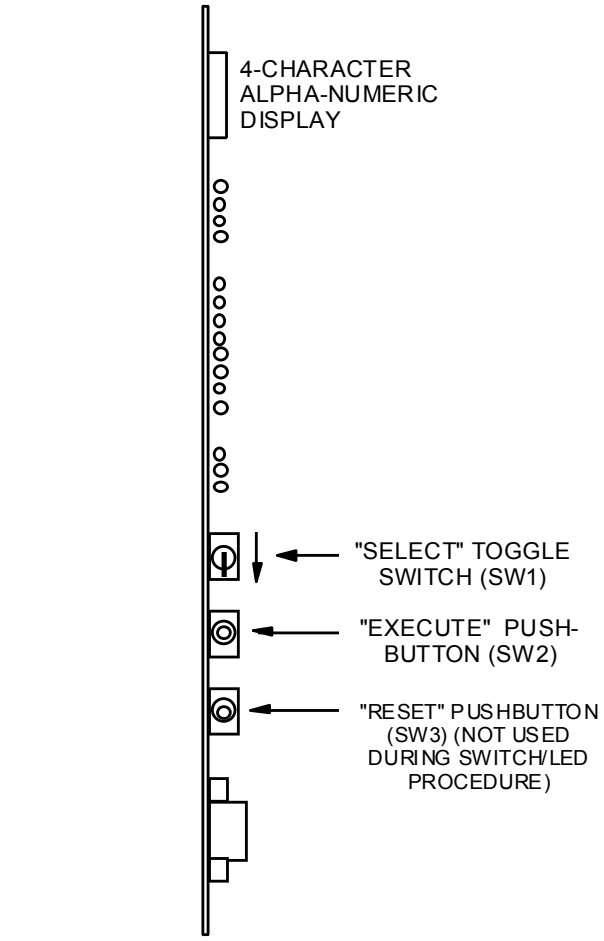
7. After all desired parameters are entered, the user may write the current configuration into the field configuration EEPROM.

8. If the new configuration is not written into the EEPROM and the unit is reset, the configuration will be lost and replaced with the values currently stored in the EEPROM.

9. At any time the user can restore the last values, stored in the EEPROM, to the active configuration memory by resetting the unit, or restore Application PROM defaults by executing the "Load Default" (**LD**) command.

10. If any parameter values must be changed, SW1 is pressed again to cycle the alpha-numeric display back to the first parameter in the menu. Remaining parameters are then run through until the desired parameter and values are reached.

ALL APPLICATIONS



ENHANCED CONTROLLER PCB
GENISYS®/MICROLOK-PLUS™
INSTALLATION

GENISYS® SERIES 2000 CARD ENCLOSURE INSTALLATION

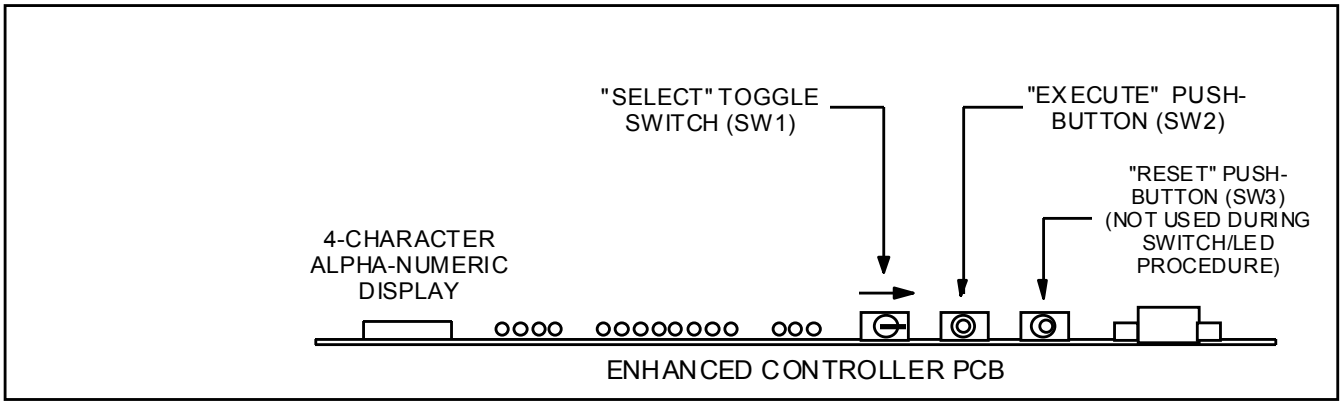


Figure 2-17. Enhanced Controller Field Configuring Using Switches and LEDs

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2.4.2.2 Procedure for ATCS MCP Application (Ref. Table 2-4)

List of Procedure Steps

Function	Display	Procedure Steps
Master port carrier test	**MT**	1 - 4
Select “logical” Slave	**SL**	6 - 8
Selected ATCS MCP address	**AT**	9 - 15
Wayside Interlocking Unit (WIU) Link Address	**AD**	16 - 19
Master Port Baud Rate	**MB**	20 - 22
Master port key-on delay	**MN**	23 - 25
Master port key-off delay	**MF**	26, 27
Master port stop bits	**MS**	28 - 30
Master port parity	**MP**	31 - 33
Master carrier option	**MX**	34 - 36
Relay output PCB control delivery time	**DT**	37 - 39
9-pin PC port baud rate	**DB**	40 - 42
Load Application software default values?	**LD**	43 - 45
Write switch-set or default values to memory?	**WR**	46 - 48

ATCS MCP

Table 2-4. Quick-Reference Guide - On-Board Switch Configuration Procedure for ATCS MCP Software

MT (Master Carrier Test):	**NO** (normal operation), **MK** (mark), **SP** (space), **CY** (50% duty cycle)
SL (Slave Select):	**1**, **2**, **3**, **4**, **5**, **6**
AT (ATCS MCP Address):	First two digits: **00**, **01**, **02**, **03**, **04**, **05**, **06**, **07**, **08**, **09**, **0A** Second two digits: Determined by first digits Third two digits: Determined by second digits Etc.
AD (WIU Link Address):	**00** ---> all hexidecimal numbers ---> **FF**.
MB (Master Baud Rate):	**01** (150), **03** (300), **06** (600), **12** (1200 BPS), **24** (2400), **48** (4800), **96** (9600), **19** (19,200) BPS
MN (Master Key-On Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**
MF (Master Key-Off Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**
MS (Master Stop Bits):	**01** (1 stop bit), **02** (2 stop bits)
MP (Master Parity):	**NO** (none), **EV** (even), **OD** (odd)
MX (Master Carrier Option):	**CO** (constant), **KY** (keyed)
DT (Relay Output PCB Control Delivery Time):	**01** (10 mS), **03** (30 mS), **07** (70 mS), **13** (130 mS), **25** (250 mS), **1S** (1 sec.), **2S** (2 sec.), **4S** (4 sec.)
DB (PC Port Baud Rate);	**01** (150), **03** (300), **06** (600), **12** (1200 BPS), **24** (2400), **48** (4800), **96** (9600), **19** (19,200) BPS
LD (Load Appli. Software Defaults?):	**N** (No), **Y** (Yes)
WR (Write Set-Up Data to EEPROM?):	**N** (No), **Y** (Yes)

ATCS MCP

Operation	Result
1. Press toggle switch SW1 as required to bring up **MT** on alpha-numeric display.	1. If the serial carrier on the Master port is to be tested, continue with step 2. Otherwise, go to step 5.
2. Press pushbutton SW2.	2. Alphanumeric display should show current Master port state.
3. Press toggle SW1 to cycle through carrier test modes.	3. Display should repeat cycle as follows: **NO** Normal operation **MK** Mark **SP** Space **CY** 50% duty cycle
4. Press SW2 when desired carrier test mode is selected.	4. Display should go dark.
5. Press toggle switch SW1 as required to bring up **SL** on alpha-numeric display.	5. If selecting "logical" Slaves, continue with step 6. Otherwise, go to step 9.
6. Press pushbutton SW2.	6. Display should show **1**.
7. Press toggle SW1 to cycle through logical Slaves 1 through 6.	7. Display should repeat **1 2 3 4 5 6.**
8. Press SW2 when desired Slave number is selected.	8. Display should go dark. All further Slave-dependent changes will be made to the selected Slave.
9. Press toggle switch SW1 as required to bring up **AT** on alpha-numeric display.	9. If selecting or changing the ATCS MCP address, continue with step 10. Otherwise, go to step 16.
10. Press pushbutton SW2.	10. Display should show **00**.
11. Press toggle SW1 to cycle through the first two hexidecimal digits of the ATCS MCP address.	11. Display should repeat **00 01 02 03 04 05 06 07 08 09 0A.**
12. Press SW2 when desired first two digits of ATCS MCP address appear on display.	12. Display should show another pair of hexidecimal digits.
13. Press toggle SW1 to cycle through the next two hexidecimal digits of the ATCS MCP address.	13. Display should repeat a sequence of 11 new hexidecimal digits, related to the previous digits selected.
14. Press SW2 when desired next two digits of the ATCS MCP address appear on the display.	14. Display should show another pair of hexidecimal digits.

ATCS MCP

Operation	Result
15. Repeat steps 13 and 14 to build complete ATCS MCP address. Continue with step 13 when the complete address is developed. **NOTE** If a wrong pair of ATCS MCP address digits are selected with SW2, the complete address must be rebuilt, starting with step 9.	15. Each time SW2 is pressed, display should show another pair of hexidecimal digits. Each time SW1 is toggled, the display should repeat another 11-digit sequence. When the last two digits of the address are selected, the display will go dark when SW2 is pressed.
16. Press toggle switch SW1 as required to bring up **AD** on alpha-numeric display.	16. If selecting or changing the wayside interlocking unit (WIU) link address, continue with step 17. Otherwise, go to step 20.
17. Press pushbutton SW2.	17. Display should show **00**.
18. Press SW1 to cycle through the WIU link address numbers.	18. Display should repeat all hexidecimal numbers between **00** and **FF**.
19. Press SW2 when desired WIU link address is selected.	19. Display should go dark.
20. Press toggle switch SW1 as required to bring up **MB** on alpha-numeric display.	20. If baud rate on Master port is to be entered or changed, continue with step 21. Otherwise, go to step 23.
21. To set Master port baud rate, press pushbutton SW2 once, then press SW1 as required to select baud rate.	21. Alpha-numeric display will show the following baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS
22. When desired baud rate is selected, press SW2 to enter rate.	22. Alphanumeric display should go dark.
23. Press toggle switch SW1 as required to bring up **MN** on alpha-numeric display.	23. If Master port key-on delay is to be entered or changed, continue with step 24. Otherwise, go to step 26.

Operation	Result
24. To set Master port key-on delay, press SW2 once, then press SW1 as required to select delay.	24. Alpha-numeric display will show the following key-on delays: **00** 0 bit times **32** 32 bit times **04** 4 bit times **36** 36 bit times **08** 8 bit times **40** 40 bit times **12** 12 bit times **44** 44 bit times **16** 16 bit times **48** 48 bit times **20** 20 bit times **52** 52 bit times **24** 24 bit times **56** 56 bit times **28** 28 bit times **60** 60 bit times
25. When desired key-on delay is selected, press SW2 to enter delay.	25. Alphanumeric display should go dark.
26. Press SW1 as required to bring up **MF** on alpha-numeric display.	26. If Master port key-off delay is to be entered or changed, continue with step 27. Otherwise, go to step 28.
27. Repeat steps 24 and 25 to select the Slave port key-off delay.	27. Same displays as Master key-on delay apply to key-off delay.
28. Press SW1 as required to bring up **MS** on alpha-numeric display.	28. IF Master port stop bits are to be entered or changed, continue with step 29. Otherwise, go to step 31.
29. To set Master port stop bits, press SW2 once, then press SW1 as required to select bits.	29. Alpha-numeric display will show the following stop bits: **01** 1 stop bit **02** 2 stop bits
30. When desired stop bits are selected, press SW2 to enter bits.	30. Alpha-numeric display should go dark.
31. Press SW1 as required to bring up **MP** on alpha-numeric display.	31. If Master port parity is to be entered or changed, continue with step 32. Otherwise, go to step 34.
32. To set Master port parity, press SW2 once, then press SW1 as required to select parity.	32. Alpha-numeric display will show the following parity options: **NO** No parity **OD** Odd parity **EV** Even parity
33. When desired parity option is selected, press SW2 to enter option.	33. Alpha-numeric display should go dark.

ATCS MCP

Operation	Result
34. Press SW1 as required to bring up **MX** on alpha-numeric display.	34. If Master port carrier option is to be entered or changed, continue with step 35. Otherwise, go to step 37.
35. To set Master port carrier option, press SW2 once, then press SW1 as required to select option.	35. Alpha-numeric display will show the following carrier options: **CO** Constant carrier **KY** Keyed carrier
36. When desired carrier option is selected, press SW2 to enter option.	36. Alpha-numeric display should go dark.
37. Press SW1 as required to bring up **DT** on display.	37. If output board control delivery time (in GENISYS® or MICROLOK-PLUS™ unit) is to be entered or changed, continue with step 38. Otherwise, go to step 40.
38. To set relay output board control delivery time, press SW2 once, then press SW1 as required to select option.	38. Alpha-numeric display will show the following control delivery times: **01** 10 milliseconds **03** 30 milliseconds **07** 70 milliseconds **13** 130 milliseconds **25** 250 milliseconds **1S** 1 second **2S** 2 seconds **4S** 4 seconds
39. When desired control delivery time is selected, press SW2 to enter time.	39. Alpha-numeric display should go dark.
40. Press SW1 as required to bring up **DB** on display.	40. If baud rate for 9-pin PC port is to be entered or changed, continue with step 41. Otherwise, go to step 43.
41. To set PC port baud rate, press SW2 once, then press SW1 as required to select rate. If desired rate is passed over, continue pressing SW1 to recycle display.	41. Alpha-numeric display will show the following PC port baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS
42. When desired PC port baud rate is selected, press SW2 to enter rate.	42. Alpha-numeric display should go dark.

Operation	Result
43. Press SW1 as required to bring up **LD** on alpha-numeric display, then press SW2 once.	43. If field configuration default values (stored in Application software) are to be used in place of switch settings, continue with step 44. If not, go to step 46.
44. Press SW1 to select **Y**, then press SW2 once.	44. When **Y** is selected, default parameters are loaded.
45. Press SW1 to select **N**, then press SW2 once.	45. Alpha-numeric display should go dark.
46. Press SW1 as required to bring up **WR** on alpha-numeric display, then press SW2 once.	46. If current active configuration values are to be written in to the EEPROM, continue with step 47. If not, go to step 48.
47. Press SW1 to select **Y**, then press SW2 once.	47. Alpha-numeric display should go dark.
48. Press SW1 to select **N**, then press SW2 once.	48. Alpha-numeric display goes dark. Return to step 1 to make any additional configuration adjustments required.

2.4.2.3 Procedure for US&S GENISYS®/500 Series Code Line Applications (Ref. Table 2-5)

List of Procedure Steps

Function	Display	Procedure Steps
GENISYS® Slave port carrier test	**ST**	1 - 4
GENISYS® Master port carrier test	**MT**	5, 6
Select “logical” Slave (DC or serial code)	**SL**	7 - 10
500 series DC code address	**AX**	11 - 13
500 series DC code control stop	**CS**	14 - 16
500 series DC code indication stop	**IS**	17, 18
GENISYS® Slave unit address	**AD**	19 - 21
GENISYS® Slave port baud rate	**SB**	22 - 24
GENISYS® Slave port key-on delay	**SN**	25 - 27
GENISYS® Slave port key-off delay	**SF**	28 - 29
GENISYS® Slave port stop bits	**SS**	30 - 32
GENISYS® Slave port parity	**SP**	33 - 35
GENISYS® Slave carrier option	**SX**	36 - 38
GENISYS® Master port baud rate	**MB**	39 - 41
GENISYS® Master port key-on delay	**MN**	42 - 44
GENISYS® Master port key-off delay	**MF**	45 - 46
GENISYS® Master port stop bits	**MS**	47 - 49
GENISYS® Master port parity	**MP**	50 - 52
GENISYS® Master carrier option	**MX**	53 - 55
Relay output PCB control delivery time	**DT**	56 - 58
9-pin PC port baud rate	**DB**	59 - 61
Load Application software default values?	**LD**	62 - 64
Write switch-set or default values to memory?	**WR**	65 - 67

Table 2-5. Quick-Reference Guide - On-Board Switch Configuration Procedure for GENISYS® and 500 Series DC Code Line Software

ST (Slave Carrier Test):	**NO** (normal operation), **MK** (mark), **SP** (space), **CY** (50% duty cycle)
MT (Master Carrier Test):	**NO** (normal operation), **MK** (mark), **SP** (space), **CY** (50% duty cycle)
SL (Slave Select):	**1**, **2**, **3**, **4**, **5**, **6**
AX (500 series DC Code Addresses):	**357**, **358**, **356**, **378**, **367**, **368**, **345**, **347**, **348**, **346**, **578**, **567**, **568**, **678**, **457**, **458**, **456**, **478**, **467**, **468**, **235**, **237**, **238**, **236**, **234**, **257**, **258**, **256**, **278**, **267**, **268**, **245**, **248**, **248, 246**
CS (500 series DC code Control Stop):	**10** --> (even numbers) --> **64**
IS (500 series DC code Indication Stop):	**10** --> (even numbers) --> **64**
AD (GENISYS® Slave Addr.):	**001** --> (all numbers) --> **255**
SB (GENISYS® Slave Baud Rate):	**01** (150), **03** (300), **06** (600), **12** (1200 BPS), **24** (2400), **48** (4800), **96** (9600), **19** (19,200) BPS
SN (GENISYS® Slave Key-On Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**
SF (GENISYS® Slave Key-Off Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**
SS (GENISYS® Slave Stop Bits):	**01** (1 stop bit), **02** (2 stop bits)
SP (GENISYS® Slave Parity):	**NO** (none), **EV** (even), **OD** (odd)
SX (GENISYS® Slave Carrier Option):	**CO** (constant), **KY** (keyed)
MN (GENISYS® Master Key-On Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**
MF (GENISYS® Master Key-Off Delay):	**00**, **04**, **08**, **12**, **16**, **20**, **24**, **28**, **32**, **36**, **40**, **44**, **48**, **52**, **52**, **56**, **60**

MS (GENISYS® Master Stop Bits):	**01** (1 stop bit), **02** (2 stop bits)
MP (GENISYS® Master Parity):	**NO** (none), **EV** (even), **OD** (odd)
MX (GENISYS® Master Carrier Option):	**CO** (constant), **KY** (keyed)
DT (Relay Output PCB Control Delivery Time):	**01** (10 mS), **03** (30 mS), **07** (70 mS), **13** (130 mS), **25** (250 mS), **1S** (1 sec.), **2S** (2 sec.), **4S** (4 sec.)
DB (PC Port Baud Rate);	**01** (150), **03** (300), **06** (600), **12** (1200 BPS), **24** (2400), **48** (4800), **96** (9600), **19** (19,200) BPS
LD (Load Appli. Software Defaults?):	**N** (No), **Y** (Yes)
WR (Write Set-Up Data to EEPROM?):	**N** (No), **Y** (Yes)

GENISYS®, US&S 500 DC

Operation	Result
1. Press toggle switch SW1 as required to bring up **ST** on alpha-numeric display.	1. If the serial carrier on the GENISYS® Slave port is to be tested, continue with step 2. Otherwise, go to step 5.
2. Press pushbutton SW2.	2. Display should also show the current Slave port state.
3. Press toggle SW1 to cycle through carrier test modes.	3. Display should repeat cycle as follows: **NO** Normal operation **MK** Mark **SP** Space **CY** 50% duty cycle
4. Press SW2 when desired carrier test mode is selected.	4. Alphanumeric display should go dark.
5. Press toggle switch SW1 as required to bring up **MT** on alpha-numeric display.	5. If the serial carrier on the GENISYS® Master port is to be tested, continue with step 6. Otherwise, go to step 7.
6. Repeat steps 2 through 4 for the Master port test.	6. Display shows same test modes as step 3.
7. Press toggle switch SW1 as required to bring up **SL** on alpha-numeric display.	7. If selecting “logical” Slaves (dc code or serial code), continue with step 8. Otherwise, go to step 10.
8. Press pushbutton SW2.	8. Display should also show **1**.
9. Press toggle SW1 to cycle through logical Slaves 1 through 6.	9. Display should repeat **1 2 3 4 5 6.**
10. Press SW2 when desired Slave number is selected.	10. Alphanumeric display should go dark. All further Slave-dependent changes will be made to the selected Slave.
11. Press toggle switch SW1 as required to bring up **AX** on alpha-numeric display.	11. If 500 Series DC code address for the selected Slave is to be entered or changed, continue with step 12. Otherwise, go to step 14.

GENISYS®, US&S 500 DC

Operation	Result
12. To set 500 series dc code address, press pushbutton SW2 once, then press SW1 as required to select address.	12. Alpha-numeric display will show the following code addresses (based on Slave unit configuration): **357** Address 357 **358** Address 358 **356** Address 356 **378** Address 378 **367** Address 367 **368** Address 368 **345** Address 345 **347** Address 347 **348** Address 348 **346** Address 346 **578** Address 578 **567** Address 567 **568** Address 568 **678** Address 678 **457** Address 457 **458** Address 458 **456** Address 456 **246** Address 246 **478** Address 478 **467** Address 467 **468** Address 468 **235** Address 235 **237** Address 237 **238** Address 238 **236** Address 236 **234** Address 234 **257** Address 257 **258** Address 258 **256** Address 256 **278** Address 278 **267** Address 267 **268** Address 268 **245** Address 245 **247** Address 247 **248** Address 248
13. Press SW2 when desired dc code address is selected.	13. Alphanumeric display should go dark.
14. Press toggle switch SW1 as required to bring up **CS** on alpha-numeric display.	14. If 500 series DC code control stop is to be entered or changed, continue with step 15. Otherwise, go to step 17.
15. To set 500 series control stop, press pushbutton SW2 once, then press SW1 as required to select CS.	15. Alpha-numeric display will show the following: **10** 10 steps **12** 12 steps **14** 14 steps **16** 16 steps **18** 18 steps **20** 20 steps **22** 22 steps **24** 24 steps **26** 26 steps **28** 28 steps **30** 30 steps **32** 32 steps **34** 34 steps **36** 36 steps **38** 38 steps **40** 40 steps **42** 42 steps **44** 44 steps **46** 46 steps **48** 48 steps **50** 50 steps **52** 52 steps **54** 54 steps **56** 56 steps **58** 58 steps **60** 60 steps **62** 62 steps **64** 64 steps
16. Press SW2 when desired DC code control stop is selected.	16. Alphanumeric display should go dark.

Operation		Result	
17.	Press toggle switch SW1 as required to bring up **IS** on alpha-numeric display.	17.	If 500 series dc indication stop is to be entered or changed, continue with step 18. Otherwise, go to step 19.
18.	Repeat steps 15 and 16 to select indication stop.	18.	Same displays as control stop (see above) apply to indication stop.
19.	Press toggle switch SW1 as required to bring up **AD** on alpha-numeric display.	19.	IF GENISYS® Slave unit address is to be entered or changed, continue with step 20. Otherwise, go to step 22.
20.	To set GENISYS® address for Slave port 1, press SW2 once, then press SW1 as required to select address.	20.	Alpha-numeric display will advance in 1-step increments, starting with **001** (Address 1) and stopping at **255** (Address 127), depending on the actual Slave unit configuration.
21.	When desired Slave address is selected, press SW2 to enter address.	21.	Alphanumeric display should go dark.
22.	Press toggle switch SW1 as required to bring up **SB** on alpha-numeric display.	22.	If baud rate on Slave port 1 is to be entered or changed, continue with step 23. Otherwise, go to step 25.
23.	To set Slave port baud rate, press pushbutton SW2 once, then press SW1 as required to select baud rate.	23.	Alpha-numeric display will show the following baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS
24.	When desired baud rate is selected, press SW2 to enter rate.	24.	Alphanumeric display should go dark.
25.	Press toggle switch SW1 as required to bring up **SN** on alpha-numeric display.	25.	If GENISYS® Slave port key-on delay is to be entered or changed, continue with step 26. Otherwise, go to step 28.

GENISYS®, US&S 500 DC

Operation	Result
26. To set Slave port key-on delay, press SW2 once, then press SW1 as required to select delay.	26. Alpha-numeric display will show the following key-on delays: **00** 0 bit times **32** 32 bit times **04** 4 bit times **36** 36 bit times **08** 8 bit times **40** 40 bit times **12** 12 bit times **44** 44 bit times **16** 16 bit times **48** 48 bit times **20** 20 bit times **52** 52 bit times **24** 24 bit times **56** 56 bit times **28** 28 bit times **60** 60 bit times
27. When desired key-on delay is selected, press SW2 to enter delay.	27. Alphanumeric display should go dark.
28. Press SW1 as required to bring up **SF** on alpha-numeric display.	28. If GENISYS® Slave port key-off delay is to be entered or changed, continue with step 29. Otherwise, go to step 30.
29. Repeat steps 26 and 27 to select the Slave port key-off delay.	29. Same displays as Slave key-on delay apply to key-off delay.
30. Press SW1 as required to bring up **SS** on alpha-numeric display.	30. IF GENISYS® Slave port stop bits are to be entered or changed, continue with step 31. Otherwise, go to step 33.
31. To set GENISYS® Slave port stop bits, press SW2 once, then press SW1 as required to select bits.	31. Alpha-numeric display will show the following stop bits: **01** 1 stop bit **02** 2 stop bits
32. When desired stop bits are selected, press SW2 to enter bits.	32. Alpha-numeric display should go dark.
33. Press SW1 as required to bring up **SP** on alpha-numeric display.	33. If GENISYS® Slave port parity is to be entered or changed, continue with step 34. Otherwise, go to step 36.
34. To set GENISYS® Slave port parity, press SW2 once, then press SW1 as required to select parity.	34. Alpha-numeric display will show the following parity options: **NO** No parity **OD** Odd parity **EV** Even parity
35. When desired parity option is selected, press SW2 to enter option.	35. Alpha-numeric display should go dark.

Operation		Result	
36.	Press SW1 as required to bring up **SX** on alpha-numeric display.	36.	If GENISYS® Slave port carrier option is to be entered or changed, continue with step 37. Otherwise, go to step 39.
37.	To set GENISYS® Slave port carrier option, press SW2 once, then press SW1 as required to select option.	37.	Alpha-numeric display will show the following carrier options: **CO** Constant carrier **KY** Keyed carrier
38.	When desired carrier option is selected, press SW2 to enter option.	38.	Alpha-numeric display should go dark.
39.	Press toggle switch SW1 as required to bring up **MB** on alpha-numeric display.	39.	If baud rate on Master port is to be entered or changed, continue with step 40. Otherwise, go to step 42.
40.	To set Master port baud rate, press pushbutton SW2 once, then press SW1 as required to select baud rate.	40.	Alpha-numeric display will show the following baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS
41.	When desired baud rate is selected, press SW2 to enter rate.	41.	Alphanumeric display should go dark.
42.	Press toggle switch SW1 as required to bring up **MN** on alpha-numeric display.	42.	If GENISYS® Master port key-on delay is to be entered or changed, continue with step 43. Otherwise, go to step 45.
43.	To set Master port key-on delay, press SW2 once, then press SW1 as required to select delay..	43.	Alpha-numeric display will show the following key-on delays: **00** 0 bit times **32** 32 bit times **04** 4 bit times **36** 36 bit times **08** 8 bit times **40** 40 bit times **12** 12 bit times **44** 44 bit times **16** 16 bit times **48** 48 bit times **20** 20 bit times **52** 52 bit times **24** 24 bit times **56** 56 bit times **28** 28 bit times **60** 60 bit times
44.	When desired key-on delay is selected, press SW2 to enter delay.	44.	Alphanumeric display should go dark.

GENISYS®, US&S 500 DC

Operation	Result
45. Press SW1 as required to bring up **MF** on alpha-numeric display.	45. If GENISYS® Master port key-off delay is to be entered or changed, continue with step 46. Otherwise, go to step 48.
46. Repeat steps 43 and 44 to select the Master port key-off delay.	46. Same displays as Master key-on delay apply to key-off delay.
47. Press SW1 as required to bring up **MS** on alpha-numeric display.	47. If GENISYS® Master stop bits are to be entered or changed, continue with step 48. Otherwise, go to step 50.
48. To set GENISYS® Master stop bits, press SW2 once, then press SW1 as required to select bits.	48. Alpha-numeric display will show the following stop bits: **01** 1 stop bit **02** 2 stop bits
49. When desired stop bits are selected, press SW2 to enter bits.	49. Alpha-numeric display should go dark.
50. Press SW1 as required to bring up **MP** on alpha-numeric display.	50. If GENISYS® Master port parity is to be entered or changed, continue with step 51. Otherwise, go to step 53.
51. To set GENISYS® Master port parity, press SW2 once, then press SW1 as required to select parity.	51. Alpha-numeric display will show the following parity options: **NO** No parity **OD** Odd parity **EV** Even parity
52. When desired parity option is selected, press SW2 to enter option.	52. Alpha-numeric display should go dark.
53. Press SW1 as required to bring up **MX** on alpha-numeric display.	53. If GENISYS® Master port carrier option is to be entered or changed, continue with step 54. Otherwise, go to step ??.
54. To set GENISYS® Master port carrier option, press SW2 once, then press SW1 as required to select option.	54. Alpha-numeric display will show the following carrier options: **CO** Constant carrier **KY** Keyed carrier
55. When desired carrier option is selected, press SW2 to enter option.	55. Alpha-numeric display should go dark.

Operation		Result	
56.	Press SW1 as required to bring up **DT** on display.	56.	If output board control delivery time (in GENISYS® or MICROLOK-PLUS™ unit) is to be entered or changed, continue with step 57. Otherwise, go to step 59.
57.	To set relay output board control delivery time, press SW2 once, then press SW1 as required to select option.	57.	Alpha-numeric display will show the following control delivery times: **01** 10 milliseconds **03** 30 milliseconds **07** 70 milliseconds **13** 130 milliseconds **25** 250 milliseconds **1S** 1 second **2S** 2 seconds **4S** 4 seconds
58.	When desired control delivery time is selected, press SW2 to enter time.	58.	Alpha-numeric display should go dark.
59.	Press SW1 as required to bring up **DB** on display.	59.	If baud rate for 9-pin PC port is to be entered or changed, continue with step 60. Otherwise, go to step 62.
60.	To set PC port baud rate, press SW2 once, then press SW1 as required to select rate. If desired rate is passed over, continue pressing SW1 to recycle display.	60.	Alpha-numeric display will show the following PC port baud rates: **01** 150 BPS **03** 300 BPS **06** 600 BPS **12** 1200 BPS **24** 2400 BPS **48** 4800 BPS **96** 9600 BPS **19** 19200 BPS
61.	When desired PC port baud rate is selected, press SW2 to enter rate.	61.	Alpha-numeric display should go dark.
62.	Press SW1 as required to bring up **LD** on alpha-numeric display, then press SW2 once.	62.	If field configuration default values (stored in Application software) are to be used in place of switch settings, continue with step 63. If not, go to step 64.
63.	Press SW1 to select **Y**, then press SW2 once.	63.	When **Y** is selected, default parameters are loaded.
64.	Press SW1 to select **N**, then press SW2 once.	64.	Alpha-numeric display should go dark.

GENISYS®, US&S 500 DC

Operation	Result
65. Press SW1 as required to bring up **WR** on alpha-numeric display, then press SW2 once.	65. If current active configuration values are to be written in to the EEPROM, continue with step 66. If not, go to step 67.
66. Press SW1 to select **Y**, then press SW2 once.	66. Alpha-numeric display should go dark.
67. Press SW1 to select **N**, then press SW2 once.	67. Alpha-numeric display goes dark. Return to step 1 to make any additional configuration adjustments required.

2.4.2.4 Procedure for US&S GENISYS®/GRS K Series Code Line Applications

(under development)

MCS-1

2.4.2.5 Procedure for Harmon MCS-1 Code Line Application

(under development)

2.4.2.6 Procedure for WB&S S2 Code Line Application

(Under Development)

ALL APPLICATIONS

2.4.3 Procedure Using Portable PC

2.4.3.1 Introduction

The PC-based field configuration procedure uses serial port on the front edge of the Enhanced Controller PCB. This is a standard 9-pin, IBM PC-compatible port that uses RS-423 (RS-232C) signals. Operating mode is asynchronous only. Baud rates range from 150 BPS to 19,200 BPS. To select the baud rate on the Enhanced Controller PCB, use the switch/LED field configuration procedure for the type of Executive software installed on the board (refer to Section 2.5.2, Operational Displays).

The Enhanced Controller board software contains a program called "DTOOL", which is used for diagnostics as well as field configuration. Two of 20 total DTOOL commands are used to select and execute field configuration data: **CONFIGURE** and **WRITE**. Some commands have subroutine levels. The first level of the **CONFIGURE** command is used to select the basic application (e.g. ATCS, DC code line). The second level under each application is used to set up specific configuration values such as baud rates, key delays etc. When all field configuration data has been selected, the **WRITE** command is used to load the data into the EEPROM on the Enhanced Controller. If the **WRITE** command is not issued, the system will revert to the previous field configuration with the next reset.

2.4.3.2 Program Rules and Notes

The PC-based field configuration is governed by the following program rules:

A. When a given command is entered, the user is automatically prompted for new field configuration data.

B. Where applicable, limits for a given parameter are displayed. When a new value is entered, it is checked against these limits.

C. Each parameter description includes the default value or setting (the default is always the current value). This is indicated by the letter **D** in [brackets] at the end of the parameter line. Example:

MASTER PORT PARITY [NONE = 0, EVEN = 1, ODD = 3 D:0]:

"D:0" indicates the default is 0 or no parity.

D. If the new value is in the proper range, a prompt for the next parameter is displayed.

E. If an invalid value is entered, the same prompt is repeated.

F. If a value is entered that does not apply to the installed Executive software, the system generates a **COMMAND COULD NOT BE EXECUTED** message.

G. If no value is entered (carriage return <CR> response only), the current parameter value remains unchanged.

H. If no value or carriage return is entered, the program automatically times out after 60 seconds and leaves all parameters in the selected configuration group unchanged.

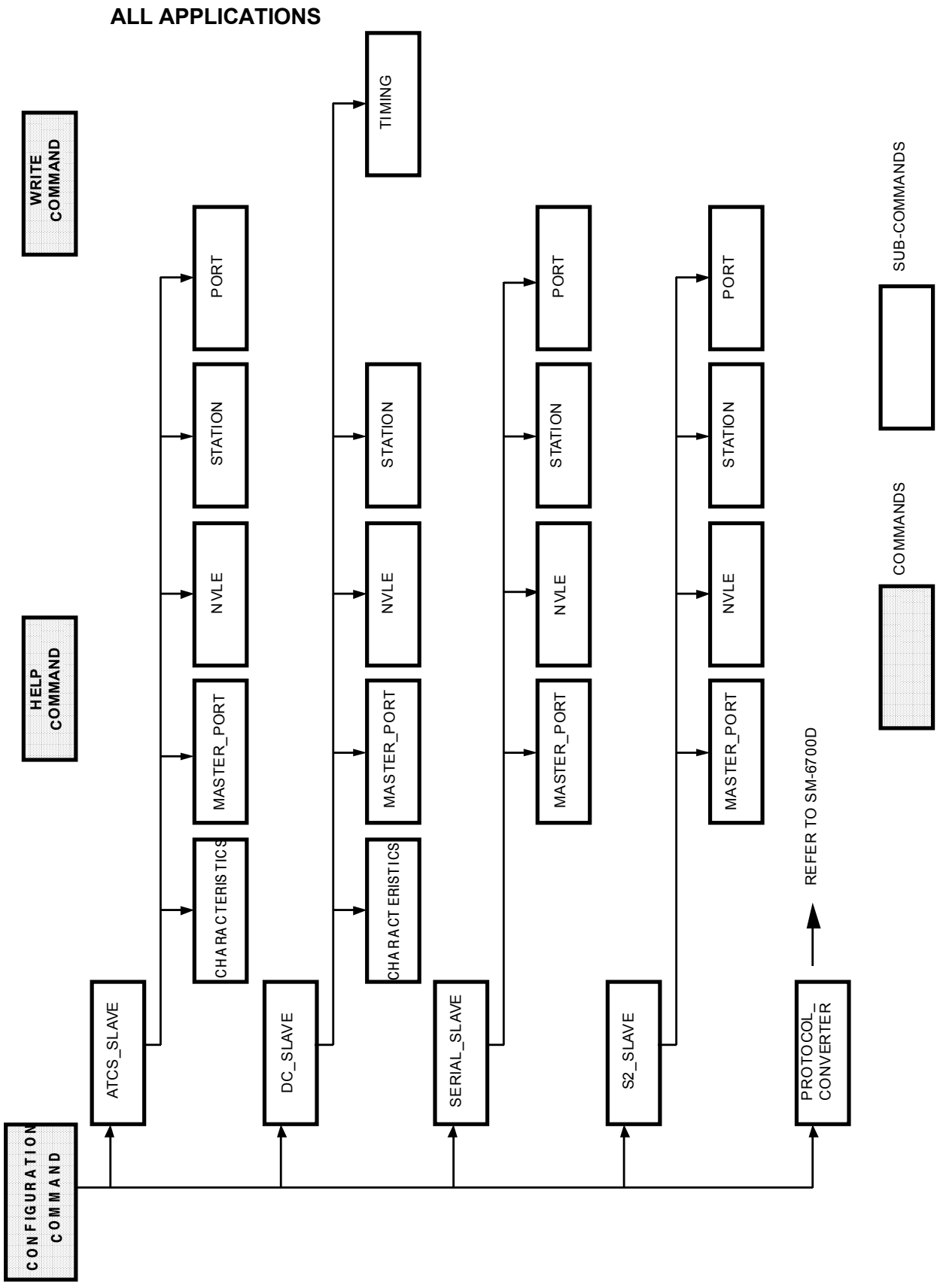


Figure 2-19. DTOOL Commands Typically Used for Field Configuration Programming

ALL APPLICATIONS

I. The program does not allow the user to skip over a given parameter; all parameters in a given set must be run through. To bypass a parameter that is not to be changed, press the carriage return (<CR>) key.

J. After all prompts have been answered, the current product configuration is updated by answering yes (**Y)** to a final configuration prompt. A no (**N**) answer leaves the configuration unchanged.

K. The DTOOL **HELP** command describes actions and options available in the **CONFIGURE** command. The **HELP** command can be consulted at any time during the configuration process. It is not an isolated command that must be entered and exited separate from the operational commands. To use the **HELP** command, type in this word before the command/subcommand in question. Example:

HELP CONFIGURE SERIAL_SLAVE MASTER_PORT

L. The DTOOL program accepts shortened command terms in lower or upper case letters. Such a command term must be distinguishable from other commands and must not have out-of-sequence letters. Example from item K above:

HE CON SER MAS

Refer to section 2.6.4, Troubleshooting with Portable PC, for DTOOL commands typically used for diagnostics.

2.4.3.3 Initial Set-Up and Program Close-Out

Operation	Result
1. With PC turned off, plug cable into 9-pin port on front edge of Enhanced Controller Board.	1. --
2. On the board, set the baud rate for the PC link using the front switches and LEDs. Refer to section 2.4.2 for procedure. (Default is 2400 BPS and normally need not be changed.)	2. --
3. Set PC to matching baud rate if a rate other than 2400 BPS has been selected.	3. --
4. Press carriage return (<CR>) on PC.	4. The PC should display the current DOS prompt string.
5. Type **DTOOL** at DOS prompt.	5. The PC should show the version number of the DTOOL software, a **HELP** instruction and the status of the communication link with the board.
6. Enter **ENAB** <CR> at **DTOOL**> prompt.	6. The PC should show: **REMOTE COMMUNICATIONS STATUS: NORMAL**
7. If the **REMOTE COMMUNICATION STATUS** message on the PC indicates a failed link, check the plug connection to the board and repeat steps 4 and 5. If the communi-cations problem does not clear, a fault is indicated.	7. --
8. Using the **DTOOL HELP** command, enter the required **CONFIGURE** command for the applicable Executive software.	8. --
9. After all values and options are selected using the **CONFIGURE** command and subcommands, go to section 2.3.4.21 (**WRITE** command) to load values/options into EEPROM on Enhanced Controller PCB.	9. --

ALL APPLICATIONS

Specific **CONFIGURE** command and subcommand procedures are covered in the following sections of the manual:

Section	Application	Parameter(s)
2.4.3.4	ATCS MCP	Code unit addresses: Health monitor, ground host, HDLC link etc. Comm. failure time out.
2.4.3.5	ATCS MCP	Slave serial port: Baud rate, key delays etc.
2.4.3.6	ATCS MCP	Slave station address
2.4.3.7	GENISYS® serial line	Slave serial port: Baud rate, key delays etc.
2.4.3.8	GENISYS® serial line	Slave station address
2.4.3.9	Harmon MCS-1	(under development)
2.4.3.10	Harmon MCS-1	(under development)
2.4.3.11	US&S 500 Series DC line	Misc. characteristics: Auto recall option, cutout time, communication failure time out, etc.
2.4.3.12	US&S 500 Series DC line	Slave station: Address, control stop, indication stop, etc.
2.4.3.13	US&S 500 Series DC line	Timing: Indication odd short, maximum control start etc.
2.4.3.14	GRS K, K1 DC line	(under development)
2.4.3.15	GRS K, K1 DC line	(under development)
2.4.3.16	GRS K, K1 DC line	(under development)
2.4.3.17	WB&S S2 serial line	Slave serial port: Baud rate, key delays etc.
2.4.3.18	WB&S S2 serial code line	Slave station address
2.4.3.19	All	Master serial port: Baud rate, key delays etc.
2.4.3.20	All	Non-Vital Logic Emulator: Control delivery time, indication change delay time

2.4.3.4 CONFIGURE Miscellaneous Address/Time Out Parameters - ATCS

Operation	Result
1. Enter **CON ATC CHA** <CR> on PC.	1. PC should show: **ATCS ADDRESS FOR MCP [D:XXXXXXXXXXXXXXX]:** where "**XXXXX.....**" is application-defined default ATCS MCP address, if the address was not defined in the application program. This address is all zeros.
2. Type in ATCS MCP address and press <CR> to enter address. Type <CR> only to keep current address. Repeat this procedure for all remaining parameters displayed on PC.	2. When valid ATCS MCP address is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new value. Remaining parameters displayed on the PC include:
ATCS ADDRESS FOR HEALTH MONITOR [D:XXXXXXXXXXXXXXX]: **ATCS ADDRESS FOR GROUND HOST [D:XXXXXXXXXXXXXXX]:** **CODE UNIT HDLC LINK ADDRESS [ODD NUMBERS BETWEEN $1 AND $FD D:$S3]:** **GROUND HDLC LINK ADDRESS [ODD NUMBERS BETWEEN $1 AND $FD D:$23]:** **MCP SOFTWARE HDLC LINK ADDRESS [ODD NUMBERS BETWEEN $1 AND $FD D:$1]:** **COMMUNICATION FAILURE TIME OUT [10 - 600 SEC. D:300 SEC.]:**	
	where "**XXXXX.....**" is application-defined value. When last parameter value in sequence (communi-cation failure time out) is entered, PC should display option of writing values (entered to this point) into configuration file, or enter-ing displayed default values. PC display: **WRITE NEW ACTIVE ATCS SLAVE CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading with **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

ATCS MCP

2.4.3.5 CONFIGURE Slave Serial Port Parameters - ATCS

Operation	Result
1. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command. (No other steps.)	1. When answer is entered, PC display should return to **DTOOL>**.

2.4.3.6 CONFIGURE Slave Serial Station Parameters - ATCS

Operation	Result
1. Enter **CON ATC STA** <CR> on PC.	1. PC should show: **SLAVE 1 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** Where "XXXX..." is application-defined default ATCS Slave station address.
2. Type in station address for Slave port 1 and press <CR> to enter address. Type <CR> only to keep current address. Repeat this procedure for all remaining ATCS Slave station addresses (as applicable) displayed on PC.	2. When valid Slave station address 1 is entered, PC should display station 2 address request. The same occurs if <CR> is typed only without a new value. Same displays should be repeated for up to 6 stations: **SLAVE 2 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** **SLAVE 3 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** **SLAVE 4 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** **SLAVE 5 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** **SLAVE 6 ATCS ADDRESS [D:XXXXXXXXXXXXXXX]:** "XXXX..." is application-defined default ATCS Slave station address. When last address in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE ATCS SLAVE STATION CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

GENISYS®

2.4.3.7 CONFIGURE Slave Serial Port Parameters - GENISYS®

Operation	Result
1. Enter **CON SER POR** <CR> on PC.	1. PC should show: **SLAVE PORT BAUD [150 - 19200 BPS. D:9600 BPS.]:**
2. Type in Slave port baud rate and press <CR> to enter rate. Type <CR> only to keep current rate. Repeat this procedure for all remaining Slave port parameters and Y/N options displayed on PC.	2. When valid Slave port baud rate is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new value. Remaining parameters and Y/N options displayed on the PC include:
	SLAVE PORT STOP BITS [1 - 2 BITS D:1 BIT(S)]: **SLAVE PORT PARITY [NONE = 0, EVEN = 1, ODD = 3 D:0]:** **SLAVE PORT KEY-ON DELAY [0 - 63 BITS D:12 BIT(S)]:** **SLAVE PORT KEY-OFF DELAY [0 - 63 BITS D:12(S)]:** **SLAVE PORT DATA ACCEPT DELAY [0 - 16 BITS D::0 BIT(S)]** **SLAVE PORT WORD RECEIVE DELAY [25 - 100 MS D:25 MS.]** **SLAVE PORT COMMUNICATION FAILURE TIMEOUT [10 - 600 SEC. D:300 SEC.]:** **CONSTANT CARRIER ON SLAVE PORT? [Y/N D:N]:**
	When last value in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE SERIAL SLAVE CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

GENISYS®

2.4.3.8 CONFIGURE Slave Serial Station Parameters - GENISYS®

Operation	Result
1. Enter **CON SER STA** <CR> on PC.	1. PC should show: **SERIAL SLAVE 1 ADDRESS [1 - 255 D:1]:**
2. Type in station address for Slave port 1 and press <CR> to enter address. Type <CR> only to keep current address. Repeat this procedure for all remaining Slave station addresses (as applicable) displayed on PC.	2. When valid Slave station address 1 is entered, PC should display station 2 address request. The same occurs if <CR> is typed only without a new value. Same displays should be repeated for up to 6 stations: **SERIAL SLAVE 2 ADDRESS [1 - 255 D:0]:** **MCS SLAVE 2 CONTROL BYTES [0 - 9 D:3.]:** **MCS SLAVE 2 INDICATION BYTES [1 - 12 D:3.]:** **SERIAL SLAVE 3 ADDRESS [1 - 255 D:0]:** **MCS SLAVE 3 CONTROL BYTES [0 - 9 D:3.]:** **MCS SLAVE 3 INDICATION BYTES [1 - 12 D:3.]:** **SERIAL SLAVE 4 ADDRESS [1 - 255 D:0]:** **MCS SLAVE 4 CONTROL BYTES [0 - 9 D:3.]:** **MCS SLAVE 4 INDICATION BYTES [1 - 12 D:3.]:** **SERIAL SLAVE 5 ADDRESS [1 - 255 D:0]:** **MCS SLAVE 5 CONTROL BYTES [0 - 9 D:3.]:** **MCS SLAVE 5 INDICATION BYTES [1 - 12 D:3.]:** **SERIAL SLAVE 6 ADDRESS [1 - 255 D:0]:** **MCS SLAVE 6 CONTROL BYTES [0 - 9 D:3.]:** **MCS SLAVE 6 INDICATION BYTES [1 - 12 D:3.]:** When last address in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE SERIAL SLAVE STATION CONFIGURATION? [Y/N D:N]:**

GENISYS®

Operation	Result
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

2.4.3.9 CONFIGURE - Harmon MCS-1 Application

(under development)

MCS-1

2.4.3.10 CONFIGURE - Harmon MCS-1 Application

(under development)

2.4.3.11 CONFIGURE Misc. Recall/Time Out Parameters - US&S 500 Series DC Code Lines

Operation	Result
1. Enter **CON DC CHAR** <CR> on PC.	1. PC should show: **AUTO RECALL OPTION? [Y/N D:N]:**
2. Answer **Y** or **N** to auto recall option and press <CR> to enter answer. Type <CR> only to keep current option. Repeat this procedure for all remaining parameters.	2. When valid auto recall option is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new option answer. Remaining parameters displayed on PC include: **CUTOUT TIME [0 = DISABLED, 30 - 300 SEC. D:0 SEC.]:** **COMMUNICATION FAILURE TIMEOUT [10 - 600 SEC. D:300 SEC.]:** When last value is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE DC LINE CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

US&S 500 DC

2.4.3.12 CONFIGURE Slave Station Parameters - US&S 500 Series DC Code Lines

Operation	Result
1. Enter **CON DC STAT** <CR> on PC.	1. PC should show: **DC SLAVE 1 ADDRESS [D:357]:**
2. Type in station address for Slave 1 and press <CR> to enter address. Type <CR> only to keep current address. Repeat this procedure for all remaining Slaves (as applicable) displayed on PC.	2. When valid Slave address 1 is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new option answer. Remaining parameters displayed onPC include: **DC SLAVE 1 CONTROL STOP [10 - 64 STEPS D:16 STEPS]:** **DC SLAVE 1 INDICATION STOP [10 - 64 STEPS D:16 STEPS]:** **DC SLAVE 2 ADDRESS [D:000]:** **DC SLAVE 2 CONTROL STOP [10 - 64 STEPS D:0 STEPS]:** **DC SLAVE 2 INDICATION STOP [10 - 64 STEPS D:0 STEPS]:** | (continues up to:) | V **DC SLAVE 6 ADDRESS [D:000]:** **DC SLAVE 6 CONTROL STOP [10 - 64 STEPS D:0 STEPS]:** **DC SLAVE 6 INDICATION STOP [10 - 64 STEPS D:0 STEPS]:** When last value in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE DC SLAVE CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

2.4.3.13 CONFIGURE Timing Parameters - US&S 500 Series DC Code Lines

Operation	Result
1. Enter **CON DC TIM** <CR> on PC.	1. PC should show: **INDICATION START PULSE [130 - 230 MS. D:180 MS.]:**
2. Type in indication start pulse value and press <CR> to enter value. Type <CR> only to keep current value. Repeat this procedure for all remaining timing functions displayed on PC.	2. When valid indication start pulse value is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new option answer. Remaining parameters displayed the PC include:

INDICATION ODD SHORT [60 - 130 MS. D:84 MS.]:
INDICATION EVEN SHORT [60 - 130 MS. D:103 MS.]:
INDICATION ODD LONG [300 - 450 MS. D:345 MS.]:
INDICATION EVEN LONG [300 - 450 MS. D:410 MS.]:
TRANSMIT MODE TIME OUT [30 - 70 MS. D:50 MS.]:
LINE QUIET BEFORE INDICATION START [1000 - 1200 MS. D:1026 MS.]:
LINE QUIET BEFORE INDICATION START (W/SS) [1200 - 1500 MS. D:1358 MS.]:
INDICATION DISABLE DELAY AFTER LINE BUSY {20 - 50 MS. D:30 MS.]:
INDICATION ABORT DELAY [230 - 350 MS. D:300 MS.]:
MINIMUM CONTROL START [230 - 350 MS. D:280 MS.]:
MINIMUM CONTROL SHORT [40 - 70 MS. D:50 MS.]:
MINIMUM CONTROL LONG [180 - 300 MS. D:250 MS.]:
MAXIMUM CONTROL LONG [475 - 590 MS. D:550 MS.]:
MINIMUM RECALL STEP 9 [500 - 800 MS. D:600 MS.]:
MINIMUM RECEIVED INDICATION START [110 - 220 MS. D:160 MS.]:
MAXIMUM RECEIVED INDICATION START [150 - 250 MS. D:250 MS.]:
MINIMUM RECEIVED INDICATION SHORT [40 - 70 MS. D:65 MS.]:
MINIMUM RECEIVED INDICATION LONG [280 - 430 MS. D:330 MS.]:
MAXIMUM RECEIVED INDICATION LONG [450 - 600 MS. D:550 MS.]:
MAXIMUM RECEIVE MODE LINE SHUNT [1500 - 3000 MS. D:2000 MS.]:
MAXIMUM NOISE IN RECEIVED SHORT [10 - 50 MS. D:40 MS.]:
MAXIMUM NOISE IN RECEIVED LONG [10 - 300 MS. D:200 MS.]:
MAXIMUM NOISE IN RECEIVED CONTROL START [10 - 350 MS. D:150 MS.]:
MAXIMUM NOISE IN RECEIVED INDICATION START [10 - 200 MS. D:40 MS.]:
LINE REVERSE THRESHOLD [100 - 200 MS. D:150 MS.]:
MINIMUM LINE QUIET TIME [500 - 600 MS. D:550 MS.]:

US&S 500 DC

Operation	Result
	When last value in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE DC LINE CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

2.4.3.14 CONFIGURE - GRS K, K1 Applications

(under development)

GRS K DC

2.4.3.15 CONFIGURE - GRS K, K1 Applications

(under development)

2.4.3.16 CONFIGURE - GRS K, K1 Applications

(under development)

WB&S S2

2.4.3.17 CONFIGURE Slave Serial Port Parameters - WB&S S2

Operation	Result
1. Enter **CON S2_SL POR** <CR> on PC.	1. PC should show: **SLAVE PORT BAUD [150 - 19200 BPS. D:300 BPS.]:**
2. Type in Slave port baud rate and press <CR> to enter rate. Type <CR> only to keep current rate. Repeat this procedure for all remaining Slave port parameters and Y/N options displayed on PC.	2. When valid Slave port baud rate is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new value. Remaining parameters and Y/N options displayed on the PC include:
	SLAVE PORT KEY-ON DELAY [5 - 63 BITS D:0 BIT(S)]: **SLAVE PORT KEY-OFF DELAY [0 - 63 BITS D:0 BIT(S)]:** **SLAVE FRAME LENGTH [32 - 128 BITS D: 32 BITS.]:** **SLAVE PORT COMMUNICATION FAILURE TIMEOUT [30 - 600 SEC. D:300 SEC.]:** **CONSTANT CARRIER ON SLAVE PORT? [Y/N D:Y]:**
	When last value in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE S2 SERIAL SLAVE CONFIG? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

2.4.3.18 CONFIGURE Slave Serial Station Parameters - WB&S S2

Operation	Result
1. Enter **CON S2_SL STA** <CR> on PC.	1. PC should show: **SERIAL SLAVE 1 ADDRESS [1 - 255 D:0]:**
2. Type in station address for Slave port 1 and press <CR> to enter address. Type <CR> only to keep current address. Repeat this procedure for all remaining Slave station addresses (as applicable) displayed on PC.	2. When valid Slave station address 1 is entered, PC should display station 2 address request. The same occurs if <CR> is typed only without a new value. Same displays should be repeated for up to 6 stations: **SERIAL SLAVE 2 ADDRESS [1 - 255 D:0]:** **SERIAL SLAVE 3 ADDRESS [1 - 255 D:0]:** **SERIAL SLAVE 4 ADDRESS [1 - 255 D:0]:** **SERIAL SLAVE 5 ADDRESS [1 - 255 D:0]:** **SERIAL SLAVE 6 ADDRESS [1 - 255 D:0]:** When last address in sequence is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE SERIAL SLAVE STATION CONFIGURATION? [Y/N D:N]:**
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

ALL APPLICATIONS

2.4.3.19 CONFIGURE Master Serial Port Parameters - ATCS, GENISYS®, US&S 500 Series, WB&S S2

Operation	Result
1. Enter configuration command/ subcommand and carriage return (<CR>) according to type of Executive software installed: For ATCS MCP application: **CON ATC MAS** <CR> For GENISYS® serial code line application: **CON SER MAS** <CR> For US&S 500 series dc code line application: **CON DC MAS** <CR>	1. PC should show: **MASTER PORT BAUD [150 - 19200 BPS. D:300 BPS.]:**

2. Type in Master port baud rate and press <CR> to enter rate. Type <CR> only to keep current rate. Repeat this procedure for all remaining Master port parameters and Y/N options displayed on PC.	2. When valid Master port baud rate is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new value. Remaining parameters and Y/N options displayed on the PC after Master port baud rate include: **MASTER PORT STOP BITS [1 - 2 BITS D:1 BIT(S)]:** **MASTER PORT PARITY [NONE = 0, EVEN = 1, ODD = 3 D:0]:** **MASTER PORT KEY-ON DELAY [0 - 63 BITS D:0 BIT(S)]:** **MASTER PORT KEY-OFF DELAY [0 - 63 BITS D:0(S)]:** **MASTER PORT NO RESP. TIME OUT [30 - 8000 MS. D:1000 MS.]:** **CONSTANT CARRIER ON MASTER PORT? [Y/N D:Y]:** **USE SECURE POLL ON MASTER PORT? [Y/N D:N]:** **USE CHECKBACK CONTROLS ON MASTER PORT? [Y/N D:N]:** **ENABLE COMMON MODE ON MASTER PORT? [Y/N D:N]:** When last parameter value in sequence (communication failure time out) is entered, PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE MASTER PORT CONFIGURATION? [Y/N D:N]:**

(Continued)

ALL APPLICATIONS

Operation	Result
3. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	3. When answer is entered, PC display should return to **DTOOL>**.

ALL APPLICATIONS

2.4.3.20 CONFIGURE Code Unit Local I/O Parameters - ATCS, GENISYS®, US&S 500 Series, WB&S S2

Operation	Result
1. Enter configuration command/ subcommand and carriage return (<CR>) according to type of Executive software installed: For ATCS MCP application: **CON ATC NVL** <CR> For GENISYS® serial code line application: **CON SER NVL** <CR> For Harmon MCS-1 serial code line application: **CON SER NVL** <CR> For US&S 500 series DC code line application: **CON DC NVL** <CR> For WB&S serial code line application: **CON S2_SL NVL** <CR>	1. PC should show: **CONTROL DELIVERY TIME [30 - 8000 MS D:50]:** Note: This parameter applies to relay output board(s) in a GENISYS® or MICROLOK-PLUS™ cardfile.
2. Type in control delivery time delay and press <CR> to enter delay. Type <CR> only to keep current delay.	2. When valid control delivery time is entered, PC should display next parameter. The same occurs if <CR> is typed only without a new value: **INDICATION CHANGE DELAY TIME [0 - 2000 MS. d:1000]:** Note: This parameter applies to optical input board(s) in a GENISYS® or MICROLOK-PLUS™cardfile.
3. Type in indication change time delay and press <CR> to enter delay. Type <CR> only to keep current delay.	3. PC should display option of writing values (entered to this point) into configuration file, or entering displayed default values. PC display is as follows: **WRITE NEW ACTIVE NVLE CONFIGURATION? [Y/N D:N]:**
4. Answer **Y** <CR> or **N** <CR> to prompt. When **DTOOL** prompt appears, any other parameter can be accessed at this time (refer to section 2.4.3.3, step 7 for listing). Refer to section 2.4.3.21 for EEPROM loading using **WRITE** command.	4. When answer is entered, PC display should return to **DTOOL>**.

ALL APPLICATIONS

2.4.3.21 WRITE Parameter Values/Options Into Enhanced Controller EEPROM

Operation	Result
1. Type **WRITE** <CR> at **DTOOL** prompt.	1. --
2. Answer **Y** <CR> or **N** <CR> to prompt.	2. When answer is entered, PC display should return to **DTOOL>**. Configuration parameters are now loaded into the EEPROM.

2.5 LED INDICATIONS (Ref. Figure 2-20)

2.5.1 Power-Up/Reset Displays

When the Enhanced Controller PCB is powered up or reset with pushbutton switch SW3, the following normal indications should occur:

1. LED 13 should light for about 1 second, then go dark. If LED 13 flashes continuously at about once per second, a problem on the board is indicated. Refer to Section 2.6, Field Maintenance, for troubleshooting instructions.

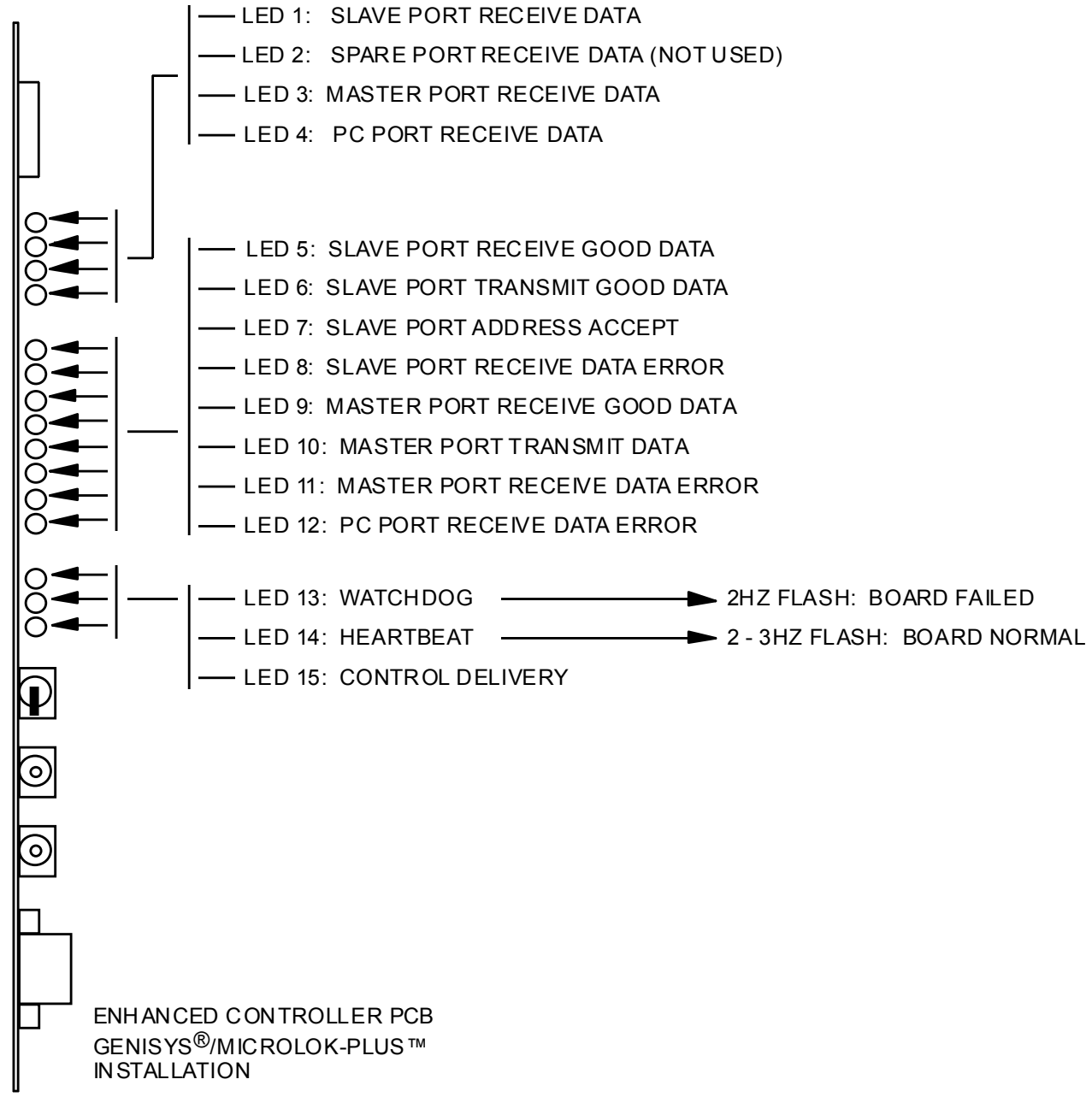
2. LED 14 should flash rapidly for about 3 seconds, then should flash continuously. This indicates the board has passed power-up/reset diagnostics.

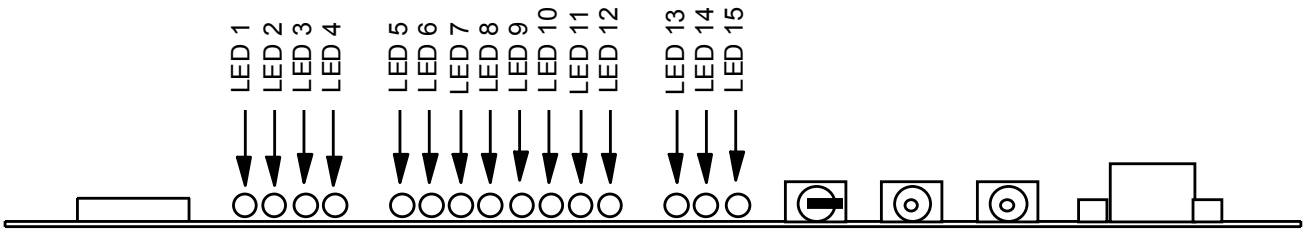
3. Depending on the system configuration, selected LEDs among LEDs 1 through 12 should flash rapidly, reporting the state of serial communications links, etc. Refer to Section 2.5.2, Operational Displays, for a detailed description of LED displays when the Enhanced Controller board has passed power-up/reset diagnostics.

NOTE

Refer to section 2.6.3.2 for error code indications on the 4-character alpha-numeric display.

ALL APPLICATIONS





GENISYS® SERIES 2000 CARD ENCLOSURE INSTALLATION

Figure 2-20. Enhanced Controller PCB LED Displays (Except Alpha-Numeric)

2.5.2 Operational Displays

Table 2-8 summaries LED displays when the Enhanced Controller PCB has passed power-up/reset diagnostics and is operational.

Table 2-8. Enhanced Controller PCB LED Indications (Except Alpha-Numeric)

LED	Description	Display
1	Slave Port Receive Data	Flashes with receipt of data from remote Master unit, otherwise dark
2	Spare Port Receive Data	None (port not used)
3	Master Port Receive Data	Flashes with receipt of data from remote Slave unit, otherwise dark
4	PC Port Receive Data	Flashes with receipt of data from portable PC, otherwise dark
5	Slave Port Receive Good Data	50 mS flash with receipt of good data on Slave port, otherwise dark
6	Slave Port Transmit Good Data	50 mS flash with transmit of good data from Slave port, otherwise dark
7	Slave Port Address Accept	50 mS flash when unit is correctly addressed by Master unit, otherwise dark
8	Slave Port Receive Data Error	On steady with receipt of bad data on Slave port. Goes dark when a good message is received.
9	Master Port Receive Good Data	50 mS flash with receipt of good data on Master port, otherwise dark
10	Master Port Transmit Data	Flashes during data transmit from Master port, otherwise dark
11	Master Port Receive Data Error	50 mS flash with receipt of bad data on Master port, otherwise dark
12	PC Port Receive Data Error	On steady with receipt of bad data on PC port. Goes dark when a good message is received.
13	Watchdog	2 Hz flash when board has failed (refer to section 2.5.1)
14	Heartbeat	2 - 3 Hz flash when board is operating normally (refer to section 2.5.1)
15	Control Delivery	Flashes when delivering outputs to GENISYS®/MICROLOK-PLUS™ output boards

ALL APPLICATIONS

2.6 FIELD MAINTENANCE

2.6.1 Introduction

This section gives procedures for field inspection, repairing and troubleshooting of the Enhanced Controller board. These procedures are intended for technicians trained in the operation and maintenance of microprocessor-based, software-driven controllers and the various classes of remote communications systems covered in this manual (e.g. ATCS, serial code, DC code).

Inspection of the Enhanced Controller board consists of an examination for any visible defects which may be causing a fault. Repairs are limited to replacement of selected plug-in chips and correction of interface wiring defects. Systematic troubleshooting procedures include:

A. Analysis of board LED fault displays

B. Analysis of communication link performance using a portable PC plugged into the board's front edge 9-pin port.

The PC-based procedure describes how to access, examine and exercise internal and remote communications circuits. However, interpretation of PC-derived test data and corrective actions are not provided. These are determined by the user's particular application of the Enhanced Controller.

NOTE

The troubleshooting procedures given in this section focus on possible problems with the Enhanced Controller board. Because this board is extensively linked with other boards and other systems, attention must also be paid to these boards/systems as a possible source of a problem. For example, in a GENISYS® installation, faults with an output board, optical-input board or the cardfile motherboard could appear on the Enhanced Controller. Refer to SM-6300B, GENISYS®/Microlok Plus Installation/Field Maintenance, Section VII for detailed system-wide troubleshooting recommendations for GENISYS® and MICROLOK-PLUS™ installations running the GENISYS® communications protocol.

No field repairs on the Enhanced Controller should be attempted beyond those described in this section. A faulty board should be removed from service and returned to US&S for shop repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

2.6.2 Inspection and Field Repairs

The Enhanced Controller PCB should be periodically inspected in conjunction with inspections of related equipment.

CAUTION

Make sure unit operating power is turned off while removing and reinstalling the enhanced controller PCB,otherwise compenent damage and/or improper operation may result.

A. Check the board material for fractures or other physical damage.

B. Examine circuit traces on both sides for breaks or unintended cross connections, and check for broken leads on components such as resistors and diodes.

C. Check for evidence of transient voltage (e.g. lightning) damage, for example burned or discolored components.

D. Make sure all plug-in chips are fully inserted with pins properly oriented.

E. In GENISYS® and MICROLOK-PLUS™ installations, check the 44-way plug that attaches to board connector “A”. Make certain all wires are properly inserted in the plug. Also confirm that all contact pins are present and properly connected to their respective wires. Refer to section 2.3.4, Serial and Parallel Communications Interfaces, to confirm proper location of serial interface wires.

Field repairs to the Enhanced Controller board are limited to replacement of these plug-in chips:

A. Executive software EPROMs - sockets “EXEC EVEN”, “EXEC ODD” (U4, U5)

B. Application software EPROMs - sockets “APPL EVEN”, “APPL ODD” (U6, U7)

Do not replace any other plug-in chips. These chips may require special calibration procedures during reinstallation.

2.6.3 Initial Troubleshooting

2.6.3.1 Preliminary Checks

Prior to troubleshooting the Enhanced Controller PCB, make these installation checks:

A. Make certain the board is fully inserted in the cardfile or card enclosure.

B. In GENISYS® and MICROLOK-PLUS™ installations, check that the 44-way serial port plug is properly connected to the board, through the rear of the cardfile.

ALL APPLICATIONS

C. In GENISYS® and MICROLOK-PLUS™ installations with output and/or optical input boards, check the LEDs on these boards. For example, dark LEDs may suggest a problem with the backplane motherboard.

D. Make certain all unit power inputs (+5V, +12V, -12V) to the Enhanced Controller are present.

   GENISYS® cardfile: Power supply PCB LEDs

   MICROLOK-PLUS™ cardfile: Power supply drawer LEDs

   GENISYS® Series 2000 Card Enclosure: Power Supply or DC Code Line/Power Supply PCB LEDs

E. Turn off power, remove Enhanced Controller and confirm that the board has the correct Executive and Application software EPROMs for the installation.

2.6.3.2 LED Fault Indications

The 15 individual LEDs on the Enhanced Controller PCB provide general diagnostic information on:

A. Serial communications links

B. Microprocessor watchdog circuit

C. Control delivery line to relay output PCB's in a GENISYS® or MICROLOK-PLUS™ cardfile

LED messages are detailed in section 2.5.2. LEDs 1 - 12 indicate when a given serial line is active and if a valid message has passed through a given serial port. Note that several of these LEDs specifically indicate message errors. LEDs 13 and 14 monitor the status of the board's microprocessor. Any failure that triggers the watchdog circuit is shown by these LEDs, including failure to reset properly. Refer to section 2.5.1, Power-Up/Reset Displays, for displays from these two LEDs during power-up or manual reset. Any control delivery problem in the Enhanced Controller or on the cardfile motherboard is shown by LED 15. A control delivery receive failure on a output board is shown by related LED on that board.

The 4-character alpha-numeric LED display on the Enhanced Controller provides various "Critical" error codes. Critical errors result in a sustained shutdown of the board and inability to reset until the source of the problem is eliminated. These errors can be generated by a fault in the Executive software, a critical interrupt of the microprocessor or by a hardware problem. Table 2-9 lists these error codes.

Table 2-9 Critical Error Codes on Alpha-Numeric Display

General Type	Error Code	Description	Notes
Executive Software	**E 00**	General Executive software fault	1
	E 01	Diagnostic Tool (DTOOL) requested a reset	
	E 02	General executive database inconsistency	1
	E 03	Serial receive queue corrupted	1
	E 04	Serial Slave port transmitter time out	1
	E 05	Slave serial transmit queue overflow	1
	E 06	Send link state error (ATCS MCP application only)	1
	E 07	Executive event timer database inconsistency	1
	E 08	All executive event timers used	1
	E 0A	Master port transmit queue full	1
	E 0B	Invalid Master port mode	1
	E 0C	Master port transmit queue corrupted	1
	E 0D	Master port transmitter time out	1
	E 0E	Timer executive linked list corrupted	1
	E 0F	DC code line indication queue corrupted	1
	E 10	Master port interrupt error	1
	E 11	Non-vital logic emulator (NVLE) logic error	1
	E 12	Key-on, key-off logic error	1
	E 13	Executive queue handler detected a corrupted queue	1
	E 14	Critical Slave control queue error	1
	E 15	WB&S S2 Slave transmitter error	1
	E 16	Bit change queue full	1
	E 17	Pool buffer management error	1
	E 18	Invalid LAPB send handler mode	1
	E 19	Bad ATCS address detected	1
Processor Interrupt	**I 100**	General interrupt fault	1
	I 102	Processor bus error	2, 4
	I 103	Address error	3, 4
System Hardware	**S 00**	General Enhanced Controller PCB fault	1
	S 01	Executive EPROM checksum error	5
	S 02	Application EPROM checksum error	6
	S 03	Watchdog late	1
	C 01	Unit configuration error	7

Notes: (1) GENISYS Series 2000 Executive detected a critical software error during normal operation. Report this fault to US&S Customer Service (1-800-652-7276).
(2) Processor addressed non-existent address space
(3) Processor generated illegal ODD address
(4) Check all EPROMs to verify that they have been correctly inserted. Verify that Application PROMs have been properly programmed. If error's cause cannot be found, contact US&S Customer Service.

(5) Check Executive PROMs for proper insertion. Replace these PROMs with a known good set, if necessary.
(6) Check Application PROMs for proper insertion. Replace these PROMs as necessary.
(7) Where applicable, check all input and output boards to insure they are inserted in the cardfile in accordance with the application program.

2.6.4 Troubleshooting with Portable PC

2.6.4.1 Introduction

The US&S "DTOOL" PC program provides means of examining various Enhanced Controller PCB stored data and setting up field configuration parameters such as baud rates and key delays. Refer to the following sections for background information on the PC link and the DTOOL program:

Section	Topic
2.3.4.8	9-pin port pinouts, wiring
2.4.2	9-pin port baud rate
2.4.3.1	General introduction to program
2.4.3.2	Program rules and notes
2.4.3.3	Initial set-up of PC link and close-out

Table 2-10 on next page summarizes all DTOOL commands. Figure 2-21 shows DTOOL commands and subcommands typically used for diagnostics. Note those commands and subcommands intended for US&S factory use only.

ALL APPLICATIONS

Table 2-10. DTOOL Commands

Command Name	Purpose/Comments
CLEAR	Resets DTOOL statistics accumulators.
COMMAND_SYNTAX	Instructional command only: Describes acceptable usage of command and subcommand terms.
CONFIGURE	Selects field configuration values/options (baud rates, key delays etc.).
CONVERT	Converts numbers from one radix to another. (Typically used for program analysis.)
DEPOSIT	Places data directly in PCB memory (1)
DISABLE	Suspends diagnostic communications protocol.
ENABLE	Reestablishes diagnostic communications protocol.
EXAMINE	Views contents of software memory (2).
EXIT	Terminates DTOOL and returns PC to DOS.
GET	Obtain miscellaneous data (controls, indications, error messages etc.).
HANGUP	Breaks phone line connection to remote unit when diagnostic connection is made by modem.
HELP	Describes purpose, use of selected command and subcommand.
LOAD_DEFAULT	Sets all field configuration values/options to factory or application EPROM defaults. Does not affect values/options stored in Field Configuration EEPROM (see **WRITE**).
MODEM	Enables user to pass (AT) commands directly to a modem (i.e. GENISYS® serial link not used).
QUIT	Terminates DTOOL and returns program to DOS.
RESET	Executes a hardware reset on the connected GENSYS® Series 2000 unit.
SET	Sets the address of the connected unit for PC/DTOOL communications. Used when multiple remote units are accessed via modem (3)

SHOW	Displays accumulated transmit/receive messages, errors, DTOOL version number for the diagnostic tool protocol.
START	Causes GENISYS® Series 2000 unit to transmit a test indication message (e.g. to central office)
WRITE	Loads current active configuration values/options to EEPROM.

(1) CAUTION: FOR FACTORY TEST ONLY. USE OF THIS COMMAND COULD RESULT IN UNRELIABLE OPERATION OR FAILURE OF THE ENHANCED CONTROLLER BOARD.

(2) Command intended for factory test only.

(3) RDB subcommand of this command intended for factory test only.

ALL APPLICATIONS

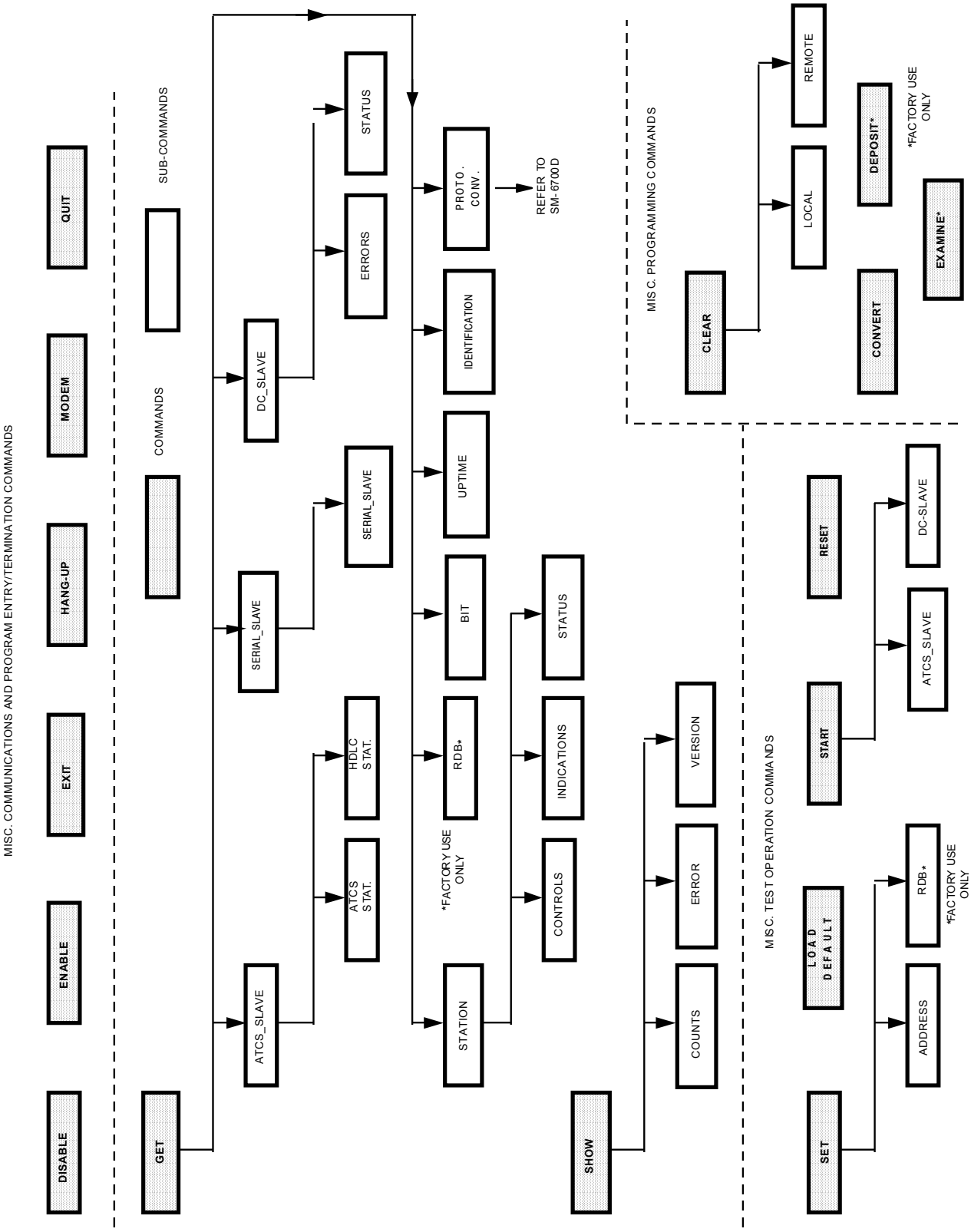


Figure 2-21. DTOOL Commands Typically Used for Diagnostics

2.6.4.2 Misc. Communications and Program Entry/Termination Commands -
All Applications:

A. **DISABLE** PC/unit serial communications
B. **ENABLE** PC/unit serial communications
C. **EXIT** DTOOL program, return to DOS (same as **QUIT**)
D. **HANGUP** phone connection (via modem) with remote unit
E. Establish **MODEM** connection with remote unit
F. **QUIT** DTOOL program, return to DOS (same as **EXIT**)

Operation	Result
A. Enter **DISA** <CR> to break PC communications with the unit under test.	A. PC will show **DTOOL>** prompt and: **REMOTE COMMUNICATIONS: DISABLED**
B. Enter **ENAB** <CR> to reestablish PC communications with the unit under test.	B. PC will show **DTOOL>** prompt and: **REMOTE COMMUNICATIONS: NORMAL**
C. Enter **EXIT** <CR> to leave DTOOL program.	C. PC should show the DOS prompt.
D. Enter **HANG** <CR> to terminate phone connection with remote unit.	D. PC will show **DTOOL>** prompt and: **REMOTE COMMUNICATIONS: DISABLED**
E. Enter **MOD** <CR> to dial up modem for remote unit. When PC screen clears, enter required phone number.	E. PC screen clears when modem is ready to dial up remote modem. Modem response depends on type and configuration of modem used.
F. Enter **EXIT** <CR> to leave DTOOL program.	F. PC should show the DOS prompt.

ATCS MCP

2.6.4.3 GET Misc. Data from Connected Unit - ATCS

(under development)

2.6.4.4 GET Message and Error Counts - US&S 500 Series Code Lines

NOTE

Use CLEAR REMOTE command/subcommand to reset message and error counts to zero (refer to section 2.6.4.10).

Operation	Result
A. Enter **GET DC**_S ERR <CR> on PC.	A. PC should show:

SHORT CONTROL START	**X**	**SHORT INDICATION**	**X**
	X	**START**	**X**
LONG CONTROL START	**X**	**LONG INDICATION START**	**X**
NOISY CONTROL START	**X**	**NOISY INDICATION START**	**X**
SHORT CONTROL STEP	**X**	**SHORT INDICATION STEP**	**X**
NOISY SHORT CONTROL	**X**	**NOISY SHORT INDICATION**	**X**
STEP	**X**	**STEP**	**X**
LONG CONTROL STEP	**X**	**LONG INDICATION STEP**	**X**
NOISY LONG CONTROL	**X**	**NOISY LONG INDICATION**	**X**
STEP	**X**	**STEP**	**X**
LONG LINE SHUNT	**X**	**LONG LINE SHUNT (IND.)**	
(CONTROL)	**X**		
TOO FEW CONTROL		**LONG LINE RECEIVE**	
STEPS	**X**		
TOO MANY CONTROL	**X**	**TOO MANY INDICATION**	
STEPS		**STEPS**	
NO CONTROL ADDRESS	**X**		
INVALID CONTROL ADDRESS			
TOO MANY TRANSITIONS			
TRANSMIT LOGIC FAILURE			
TOTAL ERRORS			

	where “X” is the total number of errors for that parameter.
B. Enter **GET DC_S STAT** <CR> on PC.	B. PC should show:

SLAVE	**GOOD CONTROL**	**GOOD RECALL**	**GOOD INDICATION**	**CONTROL ERRORS**	**I INDICATION ABORTS**

1	**X**	**X**	**X**	**X**	**X**
2	**X**	**X**	**X**	**X**	**X**
3	**X**	**X**	**X**	**X**	**X**
4	**X**	**X**	**X**	**X**	**X**
5	**X**	**X**	**X**	**X**	**X**
6	**X**	**X**	**X**	**X**	**X**
TOTAL	**X**	**X**	**X**	**X**	**X**

TOTAL GOOD CONTROL CYCLES X

	where “X” is the total number of events for that station.

GENISYS®

2.6.4.5 GET Message and Error Counts - GENISYS®

NOTE

Use CLEAR REMOTE command/subcommand to reset message and error counts to zero (refer to section 2.6.4.10).

Operation	Result
A. Enter **GET SER** <CR> on PC.	A. PC should show:
GOOD MESSAGES RECEIVED XXX XX **GOOD CONTROLS RECEIVED XXX XX** **GOOD COMMON CTL'S RECEIVED XXX XX** **GOOD ACK MESSAGES RECEIVED XXX XX** **GOOD INDICATIONS SENT XXX XX** **HARDWARE RECEIVE ERRORS XXX XX** **MESSAGE LENGTH ERRORS XXX XX** **GOOD MESSAGES FOR THIS UNIT XXX XX** **FAILED CONTROL CHECKBACKS XXX XX** **GOOD RECALLS RECEIVED XXX XX** **MESSAGE CRC ERRORS XXX XX** **ILLEGAL MESSAGE HEADERS XXX XX**	
	where "X" is the total number of events for that parameter.

WB&S S2

2.6.4.6 GET Message and Error Counts - WB&S S2

NOTE

Use CLEAR REMOTE command/subcommand to reset message and error counts to zero (refer to section 2.6.4.10).

Operation	Result
A. Enter **GET S2_SL STAT** <CR> on PC.	A. PC should show:

GOOD MESSAGES RECEIVED	**XXX XX**	**GOOD MESSAGES FOR THIS UNIT**	**XXX XX**
GOOD CONTROLS RECEIVED	**XXX XX**	**GOOD RECALLS RECEIVED**	**XXX XX**
GOOD INDICATIONS SENT	**XXX XX**		
MESSAGE LENGTH ERRORS	**XXX XX**	**MESSAGE CRC ERRORS**	**XXX XX**
CONTROL BYTE ERRORS	**XXX XX**	**DIRECTION BIT ERRORS**	**XXX XX**
OVERRUN ERRORS	**XXX XX**		

where “X” is the total number of events for that parameter.

ALL APPLICATIONS

2.6.4.7 GET Misc. Information - All Applications

NOTES

The RDB subcommand is intended for factory test only.

Operation	Result
A. To get the value of GENISYS® user-defined bits, enter on PC: **GET BIT** <DECIMAL Starting Bit Number> [DECIMAL number of bits>] <CR>	A. --
B. To get misc. ID and time-stamped data, enter **GET IDENT** <CR> on PC.	B. Using GENISYS®/500 series Executive software application as example, PC would show: **US&S GENISYS/5XX FIELD CODE UNIT** **EXECUTIVE REVISION - 00 10/15/1993** **EXECUTIVE CHECKSUM - 00704B7A** **APPLICATION CHECKSUM - 01D68913** **TOTAL UNIT UPTIME - 000 22:59:38** **LAST UNIT RESET - Thu Jun 14:11:30 1994** **LAST STATISTICS RESET - Fri Jun 03 12:47:43 1994**
C. To get total time unit under test has run since the last reset, enter **GET UPT** <CR> on PC.	C. PC should show (example): **TOTAL UNIT UPTIME - 000 22:59:38**

ALL APPLICATIONS

2.6.4.8 SHOW Misc. Internal Message and Error Counts, and DTOOL Version No. - All Applications

NOTE

Use CLEAR LOCAL command/subcommand to reset message and error counts to zero (refer to section 2.6.4.10).

Operation	Result
A. Enter **SHOW COUNT** <CR> to display total numbers of messages transmitted and received by the DTOOL program.	A. PC show: **Diagnostic Tool Message Counts** **Transmitted Messages XXXXX** **Received Messages XXXXX** where "XXXXX" is the total number of messages.
B. Enter **SHOW ERR** <CR> to display various types of errors and counts.	B. PC should show: **Invalid Errors X** **Hardware Errors X** **Buffer Overflow X** **Transmitter Time Out X** **Receiver Time Out X** **Handler Error X** **Receive CRC Error X** **No Message Header X** **Protocol Errors X** **Request Errors X** **Remote Unit Fault X** **Print Data Lost X** **Invalid Error Header X** **Total Line Errors X** **Multiple Line Errors X** where "X" is the total number of events for that parameter.
C. Enter **SHOW VERS** <CR> to display current version number of DTOOL software.	C. PC should show (example): **Union Switch & Signal Inc. Diagnostic Tool Version 1.0**

2.6.4.9 Misc. Test Operation Commands

A. **LOAD DEFAULT** Configuration Values into Unit Under Test
B. **SET** Address of Unit Under Test for DTOOL
C. **START** Transmission of Test Indication Bit - ATCS Application
D. **START** Transmission of Test Indication Bit - DC Code Line Application
E. **RESET** Unit Under Test

NOTE

The RDB subcommand of the SET command is intended for factory test only.

Operation	Result
A. Enter **LOAD DEF** <CR> to enter default configuration values.	A. PC should return to **DTOOL>** prompt after command is entered.
B. To set DTOOL address of unit under test, enter: **SET ADDR <**address> <CR> where “address” is 1 - 255.	B. PC should return to **DTOOL>** prompt after command is entered.
C. Enter **RESET** <CR> to reset unit under test.	C. PC should return to **DTOOL>** prompt after command is entered. Also, Enhanced Controller PCB LEDs should show reset condition.

ALL APPLICATIONS

2.6.4.10 Misc. Programming Commands - All Applications

A. **CLEAR** statistics accumulators in DTOOL memory.
B. **CLEAR** Statistics accumulators in memory of unit under test
C. **CONVERT** one radix to another
D. **DEPOSIT** data in memory
E. **EXAMINE** memory contents of

Operation	Result
A. Enter **CLEAR LOCAL** <CR> on PC to reset DTOOL statistics accumulators.	A. PC should show **DTOOL>** prompt (PC clearing operation complete).
B. Enter **CLEAR REMOTE** <CR> on PC to reset statistics accumulators in the connected unit (e.g. Enhanced Controller PCB in GENISYS® unit).	B. PC should show **DTOOL>** prompt (unit clearing operation complete).
C. Enter **CONV** <current radix> <desired radix> <CR> on PC.	1. Example: **DTOOL>CONV. 10 16-25** **25(10) = 19(16)**

CAUTION

The **DEPOSIT** COMMAND is intended for factory test only. Improper use of this command could result in unreliable or failed operation of the enhanced controller board.

NOTE

The EXAMINE command is intended for factory use only.

OLD S2 ON-BOARD SWITCH PROCEDURE

Function	Display	Procedure Steps
Address for Slave port 1	**A1**	1 - 3
Slave port baud rate	**SB**	4 - 6
Slave port key-on delay	**SN**	7 - 9
Slave port key-off delay	**SF**	10, 11
Master port baud rate	**MB**	12, 13
Master port key-on delay	**MN**	14, 15
Master port key-off delay	**MF**	16, 17
Master port stop bits	**ST**	18 - 20
Master port parity	**PA**	21 - 23
Master port carrier option	**CX**	24 - 26
Relay output PCB control delivery time	**DT**	27 - 29
9-pin PC port baud rate	**DB**	30 - 32
Load/no-load default parameters from Application software	**LD**	33, 34
Write/no-write parameter values to EEPROM	**WR**	35, 36

Operation	Result
1. Press toggle switch SW1 as required to bring up **A1** on alpha-numeric display.	1. If S2 address for Slave port 1 is to be entered or changed, continue with step 2, otherwise go to step 4.
2. To set S2 address for Slave port 1, press SW2 once, then press SW1 as required to select address. If desired address is passed, continue pressing SW1 to recycle display.	2. Alpha-numeric display will advance in 1-step increments, starting with **001** (Address 1) and stopping at **127** (Address 127). No other addresses are available.
3. When desired Slave address is selected, press SW2 to enter address.	3. After Slave address is entered, display should return to **A1**.
4. Press toggle switch SW1 as required to bring up **SB** on alpha-numeric display.	4. If S2 Slave port baud rate is to be entered or changed, continue with step 5, otherwise go to step 7.
5. To set Slave port baud rate, press pushbutton SW2 once, then press SW1 as required to select baud rate. If desired baud rate is passed, continue pressing SW1 to recycle display.	5. Alpha-numeric display will show the following baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS No other baud rates are available.
6. When desired Slave port baud rate is selected, press SW2 to enter rate.	6. After PC port baud rate is entered, display should return to **SB**.

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Operation	Result
7. Press SW1 as required to bring up **SN** on display.	7. If S2 Slave port key-on delay is to be entered or changed, continue with step 8. Otherwise, go to step 10.
8. To set Slave port key-on delay, press SW2 once, then press SW1 as required to select delay. If desired delay is passed, continue pressing SW1 to recycle display.	8. Alpha-numeric display will show the following key-on delays: **00** 0 bit times **32** 32 bit times **04** 4 bit times **36** 36 bit times **08** 8 bit times **40** 40 bit times **12** 12 bit times **44** 44 bit times **16** 16 bit times **48** 48 bit times **20** 20 bit times **52** 52 bit times **24** 24 bit times **56** 56 bit times **28** 28 bit times **60** 60 bit times No other key-on delays are available.
9. When desired key-on delay is selected, press SW2 to enter delay.	9. After key-on delay is entered, display should return to **SN**.
10. Press SW1 as required to bring up **SF** on display.	10. If S2 Slave port key-off delay is to be entered or changed, continue with step 11. Otherwise, go to step 12.
11. Repeat steps 8 and 9 to select the Slave port key-off delay.	11. Same displays as Slave key-on delay apply to Slave key-off delay.
12. Press SW1 as required to bring up **MB** on display.	12. If S2 Master port baud rate is to be entered or changed, continue with step 13. Otherwise, go to step 14.
13. Repeat steps 5 and 6 to select the Master port baud rate.	13. Same displays as Slave port baud rate apply to Master port baud rate.
14. Press SW1 as required to bring up **MN** on display.	14. If S2 Master port key-on delay is to be entered or changed, continue with step 15. Otherwise, go to step 16.
15. Repeat steps 8 and 9 to select the Master port key-on delay.	15. Same displays as Slave key-on delay apply to Master key-on delay.
16. Press SW1 as required to bring up **MF** on display.	16. If S2 Master port key-off delay is to be entered or changed, continue with step 17. Otherwise, go to step 18.

WB&S S2

Operation	Result
17. Repeat steps 8 and 9 to select the Master port key-off delay.	17. Same displays as Slave key-on delay apply to Master key-off delay.
18. Press SW1 as required to bring up **ST** on display.	18. IF S2 stop bits are to be entered or changed, continue with step 19. Otherwise, go to step 21.
19. To set S2 stop bits, press SW2 once, then press SW1 as required to select bits. If desired stop bits are passed, continue pressing SW1 to recycle display.	19. Alpha-numeric display will show the following stop bits: **01** 1 stop bit **02** 2 stop bits
20. When desired stop bits are selected, press SW2 to enter bits.	20. After stop bits are entered, display should return to **ST**.
21. Press SW1 as required to bring up **PA** on display.	21. If S2 Master port parity is to be entered or changed, continue with step 22. Otherwise, go to step 24.
22. To set S2 Master port parity, press SW2 once, then press SW1 as required to select parity. If desired parity is passed, continue pressing SW1 to recycle display.	22. Alpha-numeric display will show the following parity options: **NO** No parity **OD** Odd parity **EV** Even parity
23. When desired parity option is selected, press SW2 to enter option.	23. After parity option is entered, display should return to **PA**.
24. Press SW1 as required to bring up **CX** on display.	24. If S2 Master port carrier option is to be entered or changed, continue with step 25. Otherwise, go to step 27.
25. To set S2 Master port carrier option, press SW2 once, then press SW1 as required to select option. If desired option is passed, continue pressing SW1 to recycle display.	25. Alpha-numeric display will show the following carrier options: **CO** Constant carrier **KY** Keyed carrier
26. When desired carrier option is selected, press SW2 to enter option.	26. After carrier option is entered, display should return to **CX**.
27. Press SW1 as required to bring up **DT** on display.	27. If relay output board control delivery time (in GENISYS® or MICROLOK-PLUS™ unit) is to be entered or changed, continue with step 28. Otherwise, go to step 30.

WB&S S2

Operation		Result	
28.	To set relay output board control delivery time, press SW2 once, then press SW1 as required to select option. If desired option is passed, continue pressing SW1 to recycle display.	28.	Alpha-numeric display will show the following control delivery times: **01** 10 milliseconds **03** 30 milliseconds **07** 70 milliseconds **13** 130 milliseconds **25** 250 milliseconds **1S** 1 second **2S** 2 seconds **4S** 4 seconds No other times are available.
29.	When desired control delivery time is selected, press SW2 to enter time.	29.	After control delivery time is entered, the display should return to **DT**.
30.	Press SW1 as required to bring up **DB** on display.	30.	If baud rate for 9-pin PC port is to be entered or changed, continue with step 31. Otherwise, go to step 33.
31.	To set PC port baud rate, press SW2 once, then press SW1 as required to select rate. If desired rate is passed over, continue pressing SW1 to recycle display.	31.	Alpha-numeric display will show the following PC port baud rates: **01** 150 BPS **24** 2400 BPS **03** 300 BPS **48** 4800 BPS **06** 600 BPS **96** 9600 BPS **12** 1200 BPS **19** 19200 BPS No other baud rates are available.
32.	When desired PC port baud rate is selected, press SW2 to enter rate.	32.	After PC port baud rate is entered, display should return to **DB**.
33.	Press SW1 as required to bring up **LD** on display, then press SW2 once.	33.	This function allows loads (or does not load) field configuration default parameters stored in the Application software.
34.	Press SW1 as required to select **Y** or **N**, then press SW2 once to answer.	34.	When **Y** is selected, default parameters are loaded. When **N** is selected, default parameters are not loaded. When either option is selected, the display should return to **LD**.
35.	Press SW1 as required to bring up **WR** on display, then press SW2 once.	35.	This function allows writes (or does not write) field configuration values into the EEPROM.

Operation	Result
36. Press SW1 as required to select **Y** or **N**, then press SW2 once to answer.	36. When **Y** is selected, field configuration values are written. When **N** is selected, parameters are not written. When either option is selected, the display should return to **WR**.
37. Press SW1.	37. No display (end of procedure).

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SECTION III 32-BIT INPUT PCB N451441-9701
32-BIT OUTPUT PCB N451441-9601/ 32-BIT OUTPUT PCB N451441-9801

3.1 DESCRIPTION

3.1.1 General Applications

The GENISYS® Series 2000 32-Bit Input and Output PCBs are used in applications where local parallel data lines are interfaced to the system. These boards serve the same purpose as the original GENISYS® 16-bit relay-output and opto-input boards, but have twice the parallel data capacity as the earlier boards to reduce system hardware requirements.

The 32-bit boards are designed for installation in the standard GENISYS®/GENISYS® Series 2000 cardfile or the MICROLOK-PLUS™ cardfile, and may be mixed with the 16-bit boards. However, the 32-bit boards are only compatible with the GENISYS® Series 2000 Enhanced Controller PCB N451441-9101. They are not compatible with the earlier N451441-5602 Controller PCB. All boards are compatible with the standard GENISYS® DC/DC and AC/DC Power Supply Converter boards. External connections to the 32-bit boards are made on a 44-way PCB edge connector that projects through backplane slots in the cardfile. Cardfile internal bus signals are interfaced on the “B” connector of these boards.

The output mode (constant or pulsed) of the 32-Bit Output boards is defined with jumpers. Discrete LEDs on all boards allow monitoring of individual input or output lines, and addressing of a board by the Enhanced Controller.

The -9601 “Sinking” Output PCB and -9801 “Sourcing” Output PCBs differ only in the common power configuration. The -9601 board provides a negative sink path for external devices with a “+” common, while the -9801 board provides “+” voltage to external devices with a negative common.

3.1.2 Components and Basic Operation

3.1.2.1 32-Bit Input Board N451441-9701 (Ref. Figure 3-1)

Each input (B+, N-) to the -9701 board passes through a level detection circuit that only accepts signals of 6.5V dc or greater. The usable input voltage range is 8.0 to 32.0V dc, and is received on the board’s “A” connector edge. An input of the proper voltage actives an opto isolator (32 total), which serves to electrically isolate any external voltage transients from PCB or system internal circuits. At the same time, the corresponding LED is lit (32 total), displaying the presence of the input. The first three groups of eight inputs requires the same common voltage on all inputs, while different commons may be applied to each of the last group of eight inputs (Ref. Figure 3-6).

Four, 8-bit control gates enable the 32 total inputs on the board to be passed onto the cardfile data bus in 8-bit groups (under the control of the Enhanced Controller PCB). A bus address decoding circuit on the board receives two groups of external inputs: Program bit and address bit. The 4-bit program input is read on the cardfile slot “B” connector, and defines the cardfile location of the particular input board. The 4-bit address input is generated by the Enhanced Controller to enable reading of inputs of a specific input board.

ALL APPLICATIONS

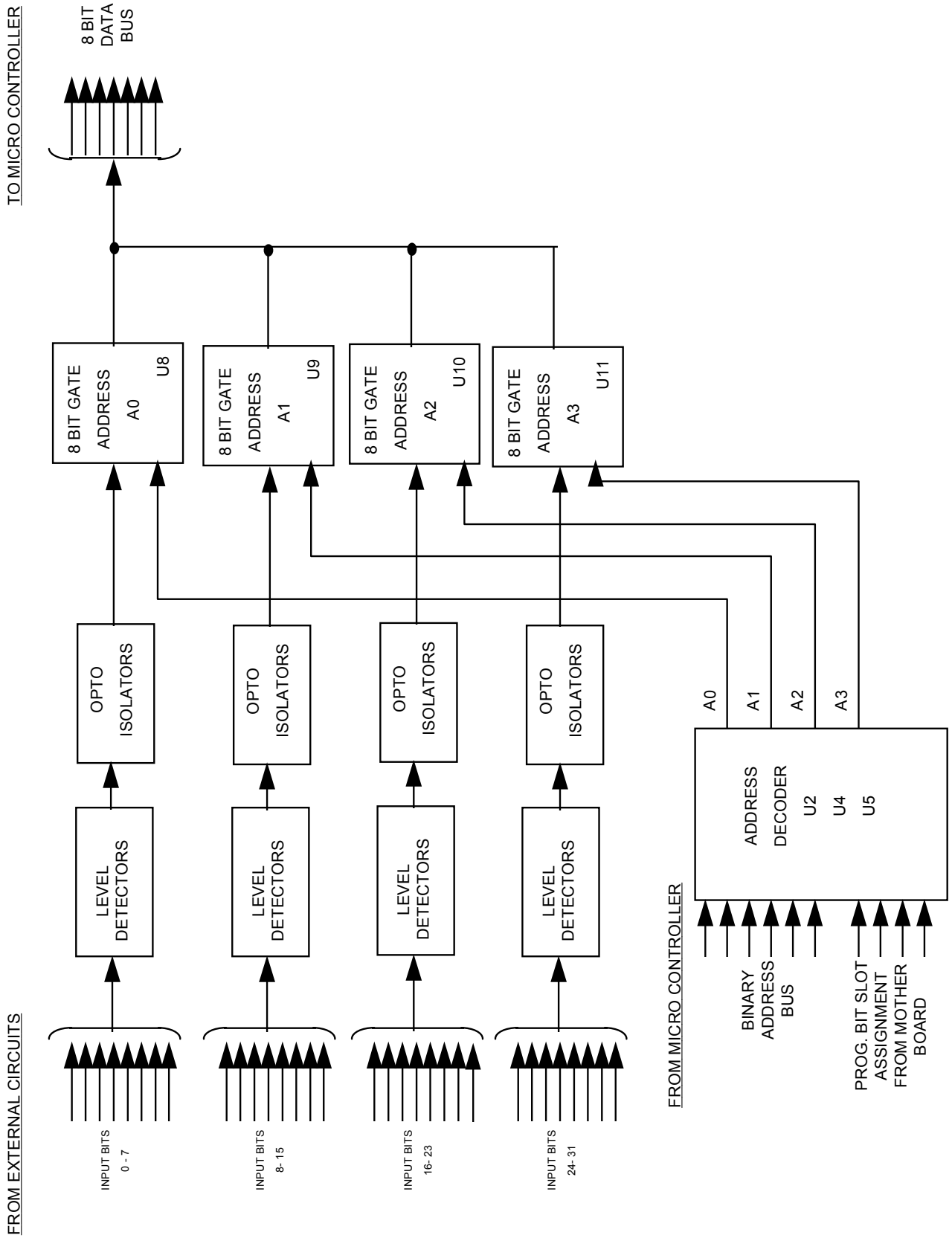


Figure 3-1. 32-Bit Input PCB Basic Block Diagram

ALL APPLICATIONS

When the Program bit and address bit agree, groups of inputs at the 8-bit control gates are released to the cardfile system bus. When these bits are not in agreement, input data is not released. Four additional LEDs report when individual 8-bit groups of input data are addressed by the Enhanced Controller board

3.1.2.2 32-Bit Output Boards N451441-9601, -9801 (Ref. Figure 3-2)

Data outputs from the Enhanced Controller PCB (via 8-bit cardfile bus) are locked in four 8-bit storage buffers, each in sequence. When each 8-bit byte is placed on the bus, the Enhanced Controller sends the address bit for the respective 8-bit storage buffer, followed by a data strobe pulse which triggers the respective buffer. Two methods of data output to external circuits are available on the 32-Bit output boards: Constant and pulsed.

In the constant mode, data stored in the four 8-bit buffers is immediately output to external circuits as soon as each buffer receives data. Each data output in this mode remains “on” until turned off by the Enhanced Controller. In the Strobe mode, data in the 8-bit storage buffers is held until the Enhanced Controller sends a “Deliver” pulse. The Deliver pulse sets off a 0.5 second output pulse during which time the selected external circuits are energized. A single jumper (JP1) on the 32-Bit Output board is installed to select Constant or Strobe delivery. This jumper configures a single mode select circuit that controls the delivery mode of all 32 outputs.

Each output is protected with an opto isolator that electrically isolates PCB and system internal circuits from possible transient voltages induced on the output circuits. These opto-isolators are also used to execute the output mode selected with the mode-select circuit. In the constant mode, all isolators are set high to pass data as soon as it appears on the 8-bit storage buffers. In the strobe mode, the isolators are set high only during the 0.5 second output pulse.

The 32-Bit Output boards use 32 solid-state, field effect transistors (FETs) to pass output energy to external circuits; relay contacts are not used. On the -9801 “Sourcing” board, B+ and N- lines are configured so that the board routes battery positive to external device with a negative common. On the -9601 “Sinking” board, B+ and N- lines are configured to provide a negative path for external devices with a positive common. Individual LEDs are provided to display the “on” state of each output.

A bus address decoding circuit on the -9601 and -9801 boards receives two external inputs: Program bits and address bits. The 4-bit program input is read on the cardfile slot “B” connector, and defines the cardfile location of the particular output board. The 4-bit address input is generated by the Enhanced Controller prior to generating outputs from a specific board. When the Program bit and address bit agree, output bits on the cardfile data bus are accepted for temporary storage and delivery. When these bits are not in agreement, output bits are not accepted for delivery to external circuits. Four additional LEDs report when individual 8-bit groups of output data are supplied by the Enhanced Controller board.

ALL APPLICATIONS

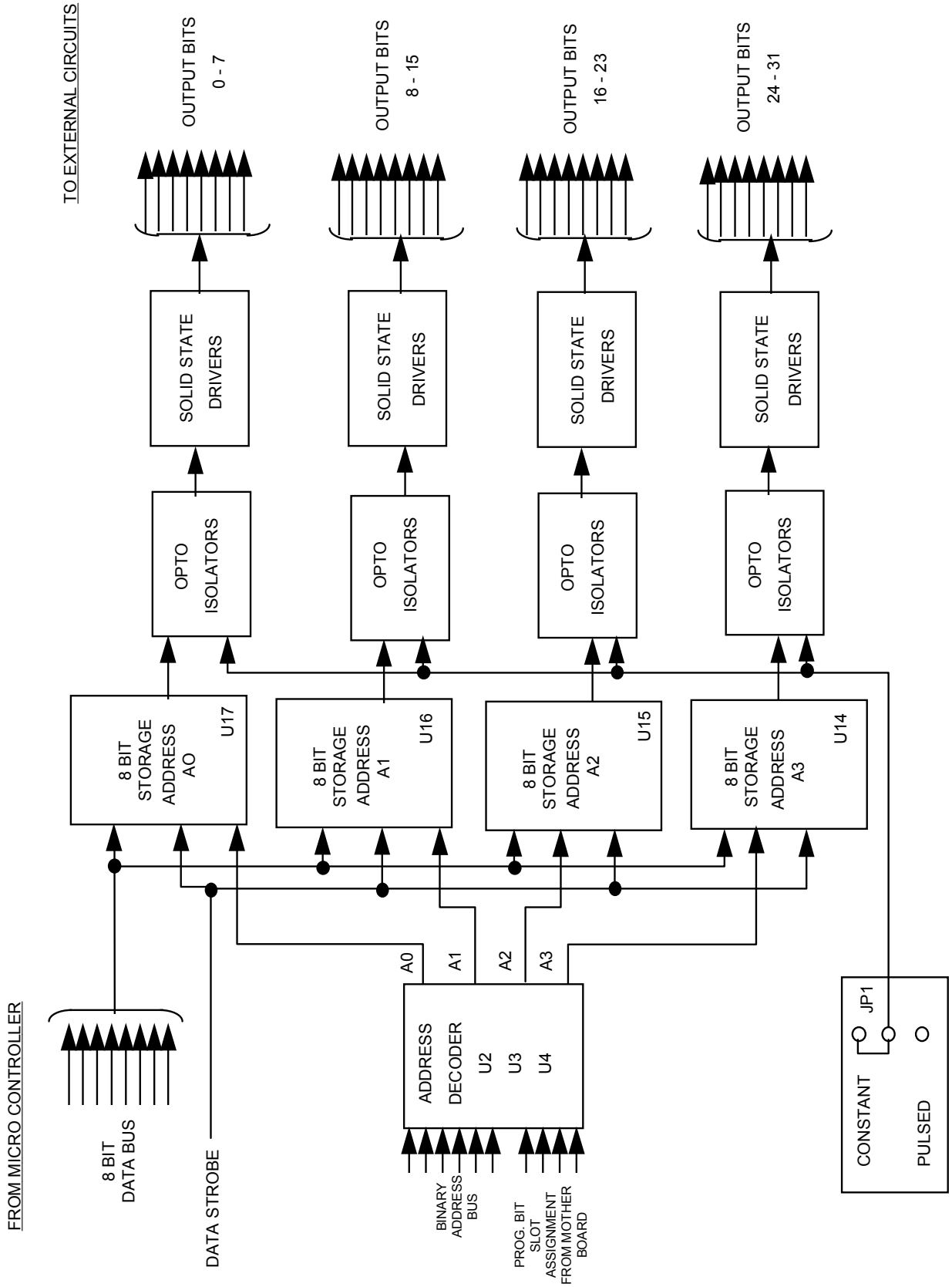


Figure 3-2. 32-Bit Output PCBs - Basic Block Diagram

3.2 SPECIFICATIONS

US&S Part Nos.:	N451441-9601 (32-Bit Sinking Output PCB)
	N451441-9701 (32-Bit Input PCB)
	N451441-9801 (32-Bit Sourcing Output PCB)
Board Size:	Standard GENISYS®/MICROLOK® size
Installation:	GENISYS®/GENISYS® Series cardfile, slots J3 through J18
	MICROLOK-PLUS™ cardfile (non-vital section), slots
Connections:	44-way PCB edge connector “A” through cardfile backplane slots
	44-way PCB edge connector “B” to cardfile backplane plug on motherboard
Input Board Voltage:	Detection threshold: 6.5V dc (min.), ±0.3V dc
	Range: 8.0 to 32.0V dc
Input Board Current:	4 mA @ 32.0V dc
Output Boards Voltage:	Range: 8.0 to 32.0V dc
Output Boards Current:	750 mA (resistive)
Output Boards Strobe Time:	0.5 second
Output Boards Configuration:	N451441-9601: N- for external device B+
	N451441-9801: B+ for external device N-
User Controls:	Output boards: Mode-select jumper
	Input board: None
User Displays:	32 discrete LEDs: Monitor individual I/O lines (all boards)
	4 discrete LEDs: Monitor 8-bit byte addressing from Enhanced Controller
Board Environmental Limits:	-40°C to +70°C 95% relative humidity (non-condensing)

ALL APPLICATIONS

3.3 INSTALLATION

3.3.1 Shipment Inspection

Prior to installation, the 32-Bit Input or Output board should be inspected for possible damage during shipping. Check for loose or missing components, broken solder leads, breaks in tracks, fractures in the board material etc. Damaged boards should be returned to US&S for repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

3.3.2 Pre-Installation Adjustments (Ref. Figure 3-3)

The 32-Bit Output boards incorporate a jumper for selecting constant or pulsed delivery of outputs. Set jumper JP1 as follows:

"CON" position for constant delivery
"PUL" position for pulsed delivery

No other adjustments are required on the output boards before installation.

No adjustments are required on the 32-Bit Input board before installation.

3.3.3 Installation In Cardfiles (Ref. Figure 3-4)

The 32-Bit Input and 32-Bit Output boards are installed in the non-vital I/O section of the GENISYS®/GENISYS® Series 2000 18-slot cardfile, or the MICROLOK-PLUS™ cardfile.

CAUTION

Make sure unit operating power is off when installing the 32-bit boards, otherwise component damage and/or unreliable operation may result.

Cardfile installation rules are as follows:

A. The cardfile must be equipped with Enhanced Controller PCB N451441-9101.

B. In systems with both input and output boards, the 32-Bit Output boards are always installed to the left of the input boards.

C. Input and Output boards may be installed in clusters or with empty cardfile spaces between boards. (If empty spaces are present, these must be specified as dummy locations in the application logic.)

D. The 32-bit boards may be mixed with 16-bit boards; rule "B" above is still applicable. (16-bit boards are compatible with the Enhanced Controller PCB.)

ALL APPLICATIONS

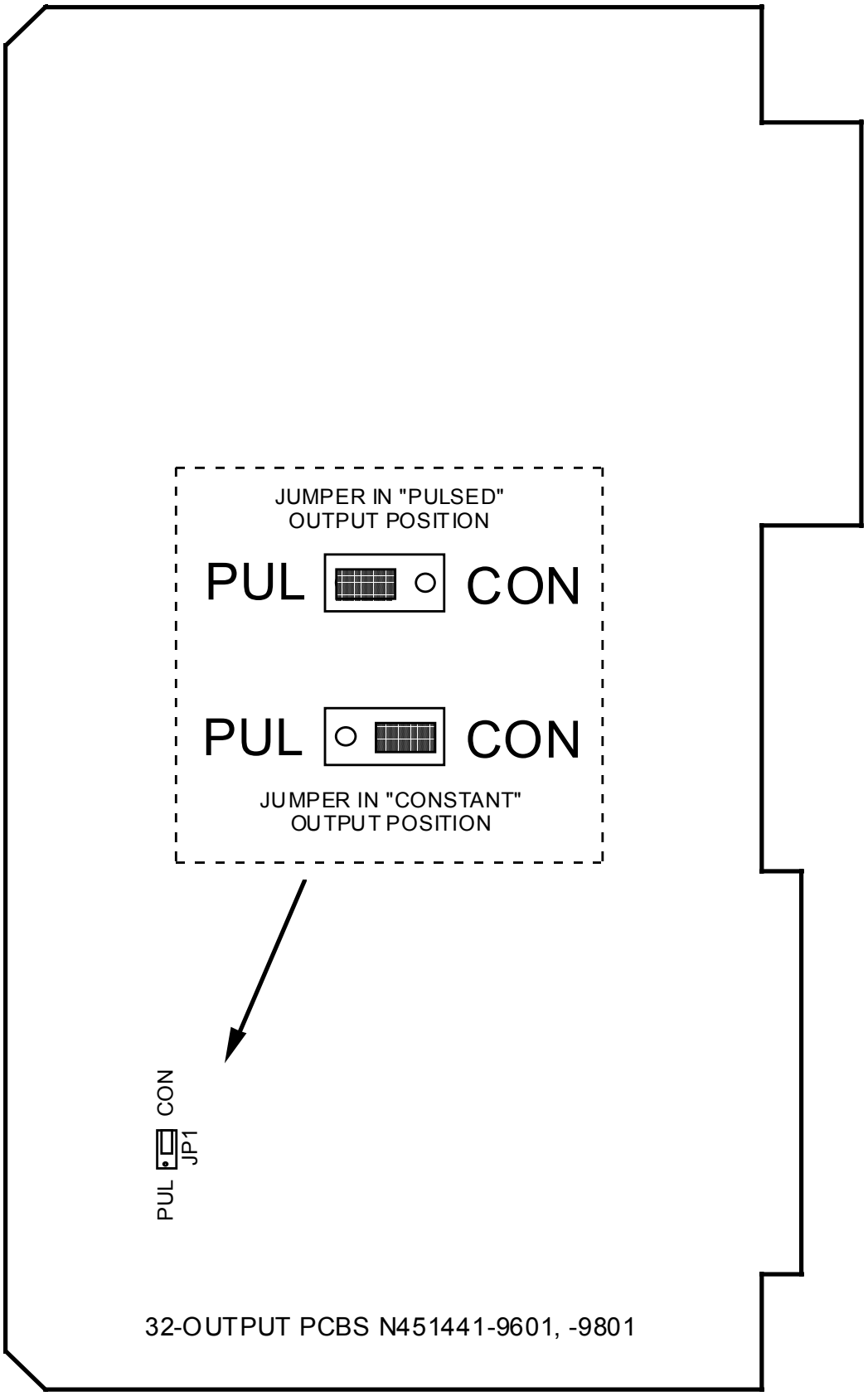
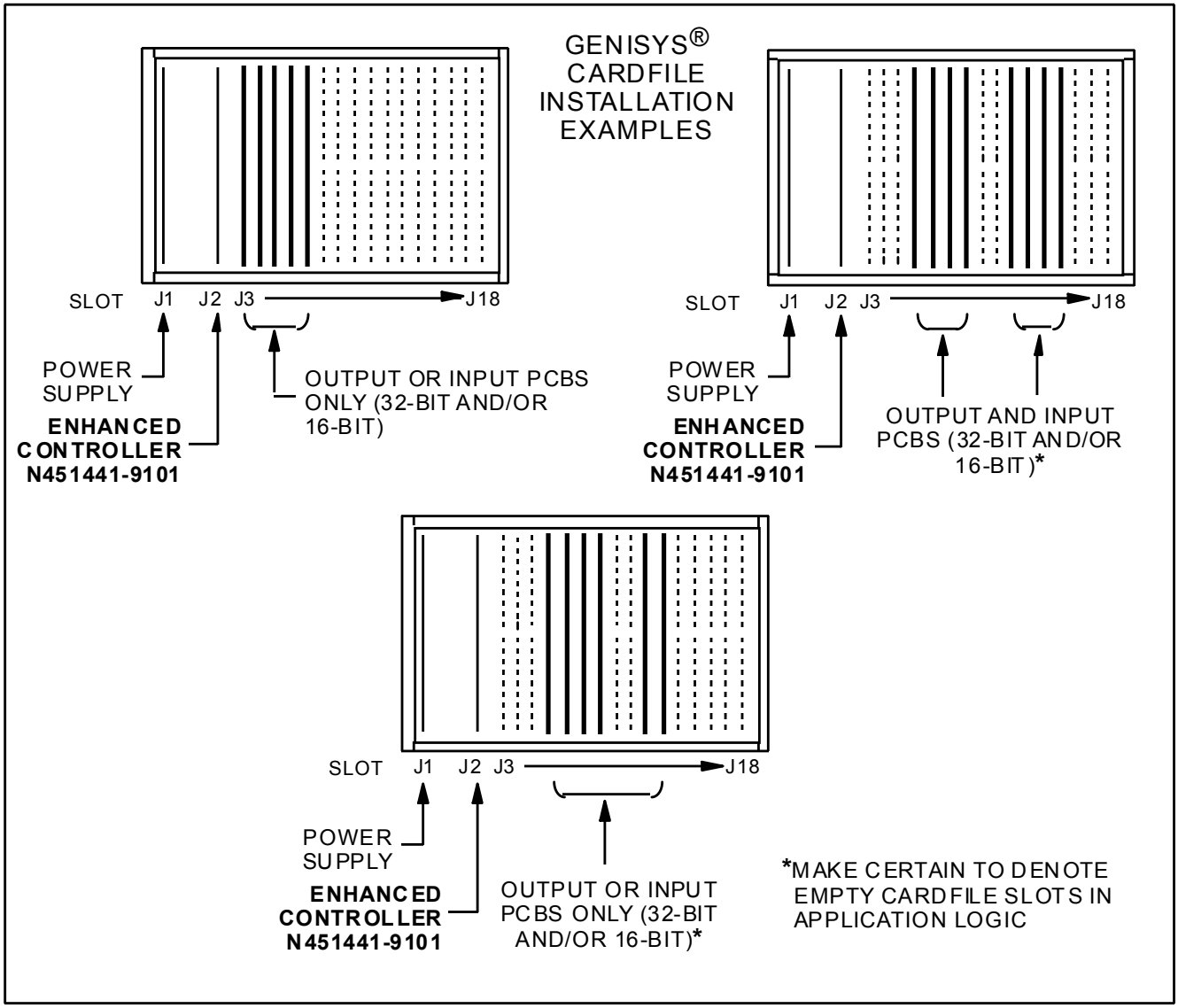


Figure 3-3. 32-Bit Output PCB - Output Mode Select Jumper

ALL APPLICATIONS



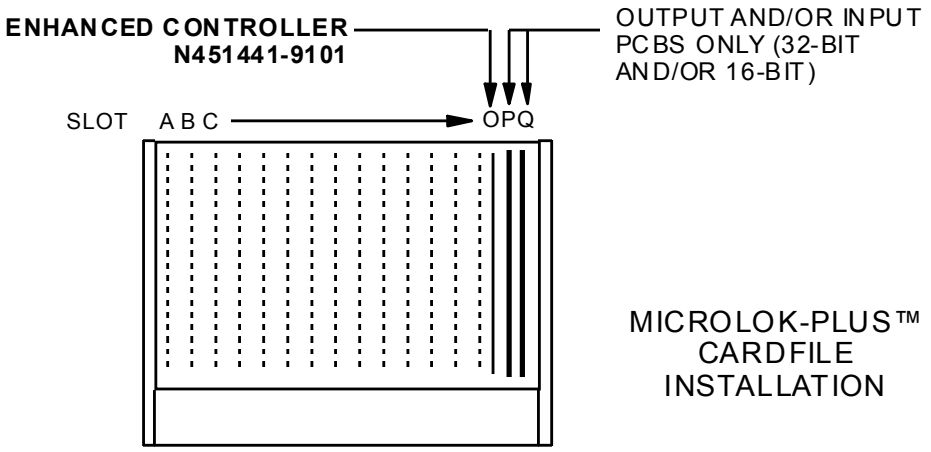


Figure 3-4. Sample Cardfile Installations of 32-Bit Input and Output PCBs

3.3.4 Connector/Cable Assemblies

Connector/cable assemblies for the 32-Bit Input and Output boards are not available from US&S as standard products. However, connector kits are available in US&S kit part no. N451170-1001. The construction and test procedure is as follows:

NOTE

The following information is intended as a general guide for the design and assembly of the 32-bit I/O interfac-ing cables. The rules set down should be followed in accordance with the overall project requirements, proper engineering practices and common sense. Contact US&S for any interfacing details not covered in this manual.

A. General Rules

Each external interface is connected to the unit using a printed circuit board edge connector housing and contacts mounted on a strain-relief bracket. Generic rules for constructing the assembly are as follows:

1. In general, shielded cabling is not required for the non-vital 32-bit I/O interfaces. However, if the application does require shielded cable for noise protection, connect only one end of the shield to ground, not both. When shielded cable is used, check all active wires in the cable for possible shorts to the shield.

2. When twisted-pair wiring is required by the application, twists should be made at a minimum of two twists per foot.

3. The contact used to terminate the cardfile end of the cable can accept one #18 to #22 AWG wire with a nominal outside diameter of .055 to .080 inches. Or, it can accept two #22 wires with a maximum outside diameter of .120 inches. If a configuration with a wire larger than one #18 wire or more than two #22 wires is required, contact US&S for additional information.

4. To avoid strain on the cable connection, each cable should be connected to the cardfile mounting bar or an external mounting bar. Also, add a service loop to the cable at the mounting bar so that the connector can be easily accessed during maintenance.

B. Typical Construction Procedure (Ref. Figure 3-5)

1. Cut cable (Item 1) and common wire (Item 4) to required length.

2. On 44-pin connector end of cable, strip and discard 3-1/4 inches of outer jacket. On open end of cable, strip and discard 19 inches of outer jacket.

3. On both ends of cable, identify spare wires using the applicable wiring diagram. Fold back the spare wires, bundle and tape to the body of the cable.

4. Assemble cable connector using Item 6 and Items 8 through 13 (Ref. view C).

ALL APPLICATIONS

5. Line up end of cable jacket with end of tie wrap hole (Ref. view B). Using the wiring diagram, place color-coded active wires through proper holes in connector. Bend wire along bracket for neat, even spacing (Ref. view B). This will leave approximately one inch protruding from the block for the end wires, with longer lengths protruding from the center.

6. Make sure all wires lay flat against the bracket with no tangles. Place cable tie (Item 14) through holes in bracket and tighten cable tie (Ref. view A) just enough to hold cable.

7. Cut all wires flush with the front of the block.

8. Pull wires out of the block and strip 1/8 inch of insulation. Then crimp the wire in contact (Item 7) with crimping tool (Item 15).

9. Insert contacts (Item 7) in proper position in block, referring to the applicable wiring diagram. Pull-test each wire.

10. Insert dummy contacts (Item 7) in all unused positions on block.

11. Roll up the #22 red common wire (Item 4).

12. Insert keying plug (Item 5) between applicable pins.

13. Apply label (Item 3) to housing per view A.

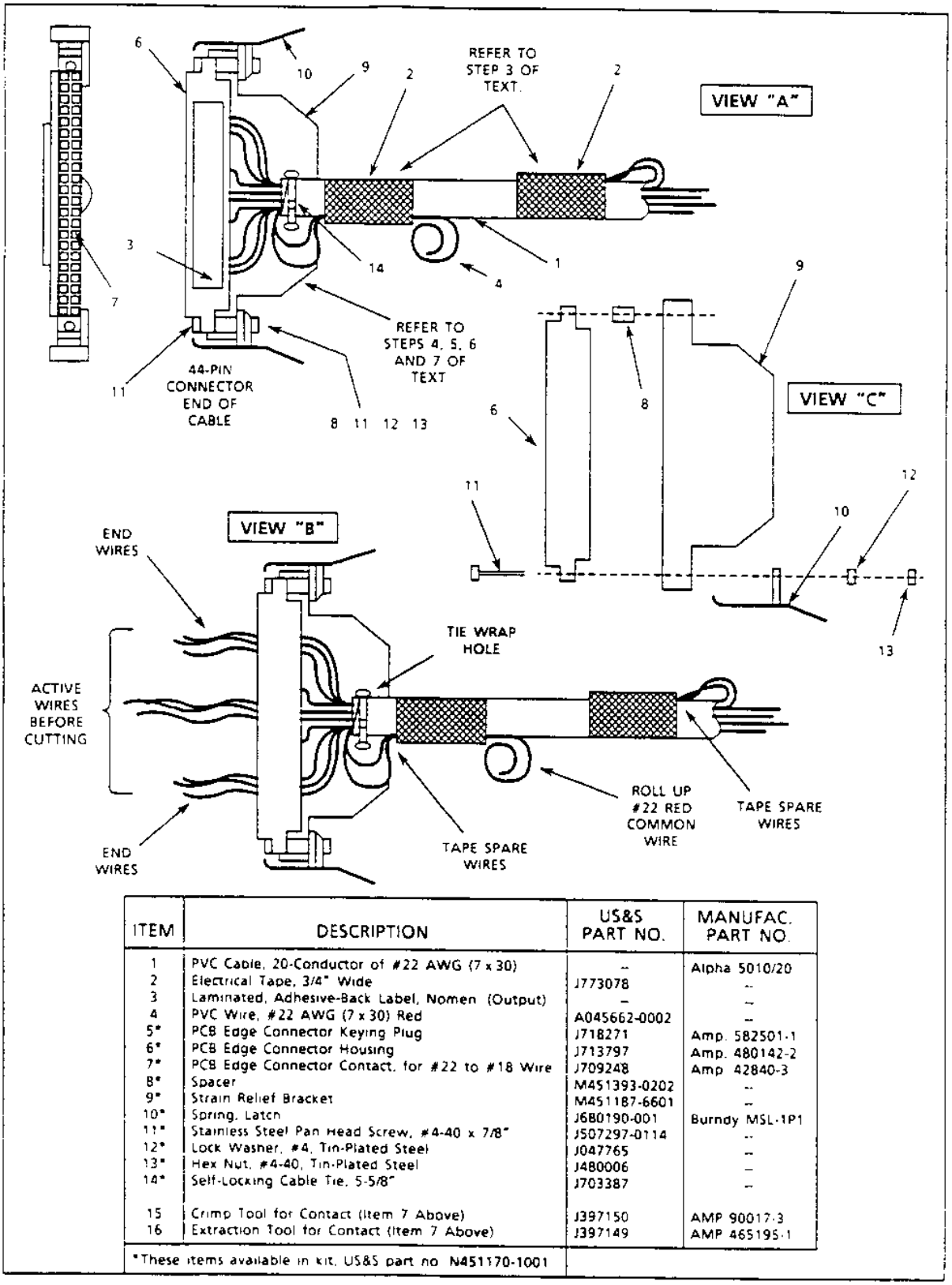
14. Inspect assembly as follows:

    Mechanical

    a. Check that color-coded wires agree with wiring diagram.
    b. Check that all assembly notes were followed.
    c. Make sure the cable is free of nicks, cracks and burns.
    d. Make sure the connector hardware is fastened securely.

    Electrical

    a. Check for shorts (individual signal wires to all other signal wires).
    b. Check continuity of all signal wires.



ITEM	DESCRIPTION	US&S PART NO.	MANUFAC. PART NO.
1	PVC Cable, 20-Conductor of #22 AWG (7 x 30)	--	Alpha 5010/20
2	Electrical Tape, 3/4" Wide	J773078	--
3	Laminated, Adhesive-Back Label, Nomen (Output)	--	--
4	PVC Wire, #22 AWG (7 x 30) Red	A045662-0002	--
5*	PCB Edge Connector Keying Plug	J718271	Amp. 582501-1
6*	PCB Edge Connector Housing	J713797	Amp. 480142-2
7*	PCB Edge Connector Contact, for #22 to #18 Wire	J709248	Amp 42840-3
8*	Spacer	M451393-0202	--
9*	Strain Relief Bracket	M451187-6601	--
10*	Spring, Latch	J680190-001	Burndy MSL-1P1
11*	Stainless Steel Pan Head Screw, #4-40 x 7/8"	J507297-0114	--
12*	Lock Washer, #4, Tin-Plated Steel	J047765	--
13*	Hex Nut, #4-40, Tin-Plated Steel	J480006	--
14*	Self-Locking Cable Tie, 5-5/8"	J703387	--
15	Crimp Tool for Contact (Item 7 Above)	J397150	AMP 90017-3
16	Extraction Tool for Contact (Item 7 Above)	J397149	AMP 465195-1

*These items available in kit, US&S part no N451170-1001

Figure 3-5. Typical 32-Bit I/O Connector/Cable Mechanical Assembly

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3.3.5 Basic Application Circuits

Figures 3-6, 3-7 and 3-8 show basic applications of the 32-Bit Input and Output boards to external circuits. Key on-board interfacing/driving components are included for reference. Note the battery/common differences between the -9601 “Sinking” and -9801 “Sourcing” output PCBs.

Consult detailed application circuit diagrams for variations and additional details in these circuits.

3.4 LED INDICATIONS

The 32-Bit Input and Output PCBs are each equipped with 32 discrete LEDs for monitoring individual input or output lines. When a given line is energized, the corresponding LED lights for the duration of the data bit “on” time.

All 32-bit boards are also equipped with 4 discrete LEDs for monitoring 8-bit data byte addressing by the Enhanced Controller PCB. When a given line is energized, the corresponding LED lights for the duration of the addressing bit “on” time. As this time is very short, these LEDs light very dimly.

Figure 3-9 shows the board edge arrangement of the LEDs for both types of boards.

ALL APPLICATIONS

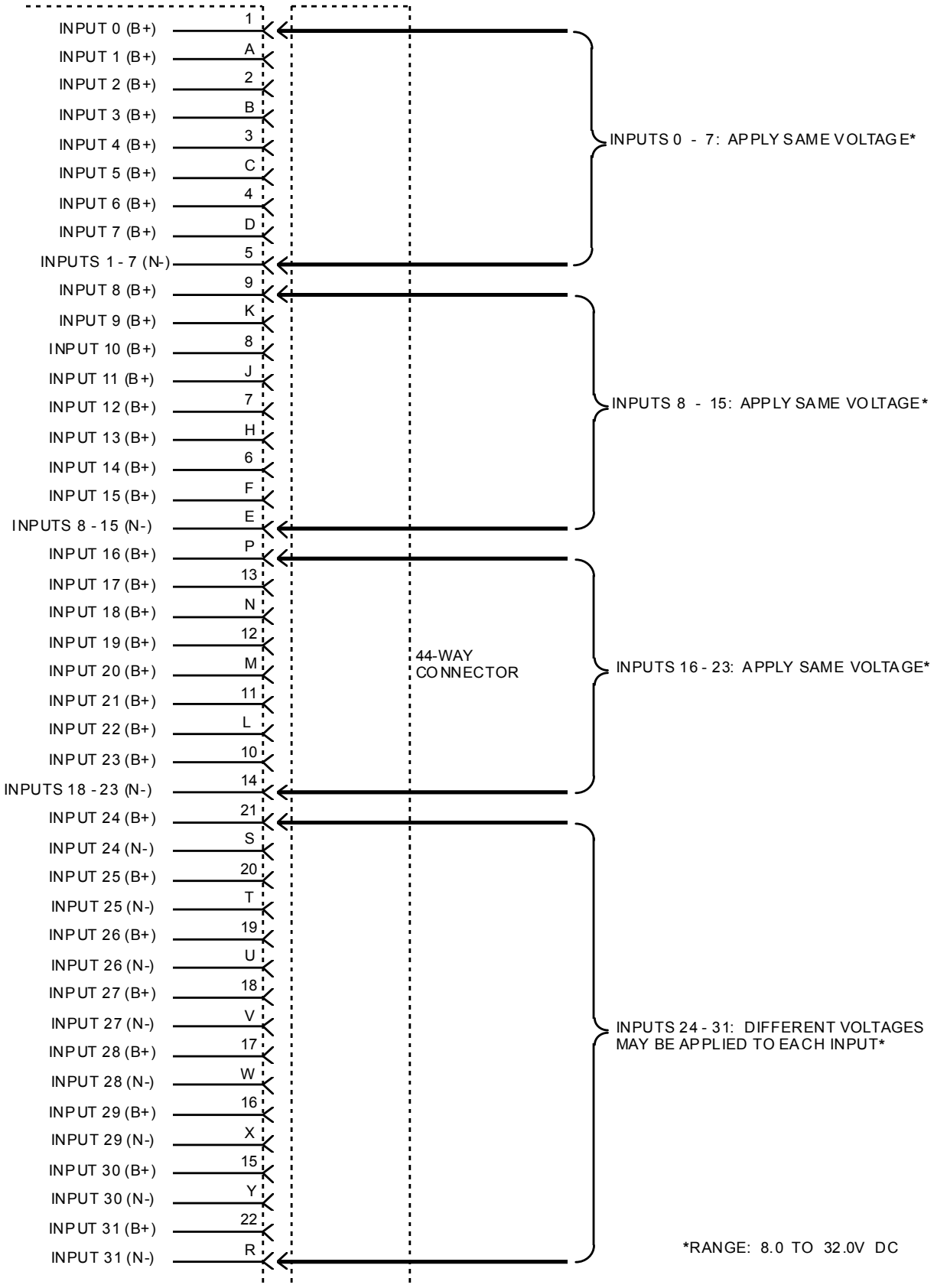

Figure 3-6. Basic Wiring of 32-Bit Input PCB N451441-9701

ALL APPLICATIONS

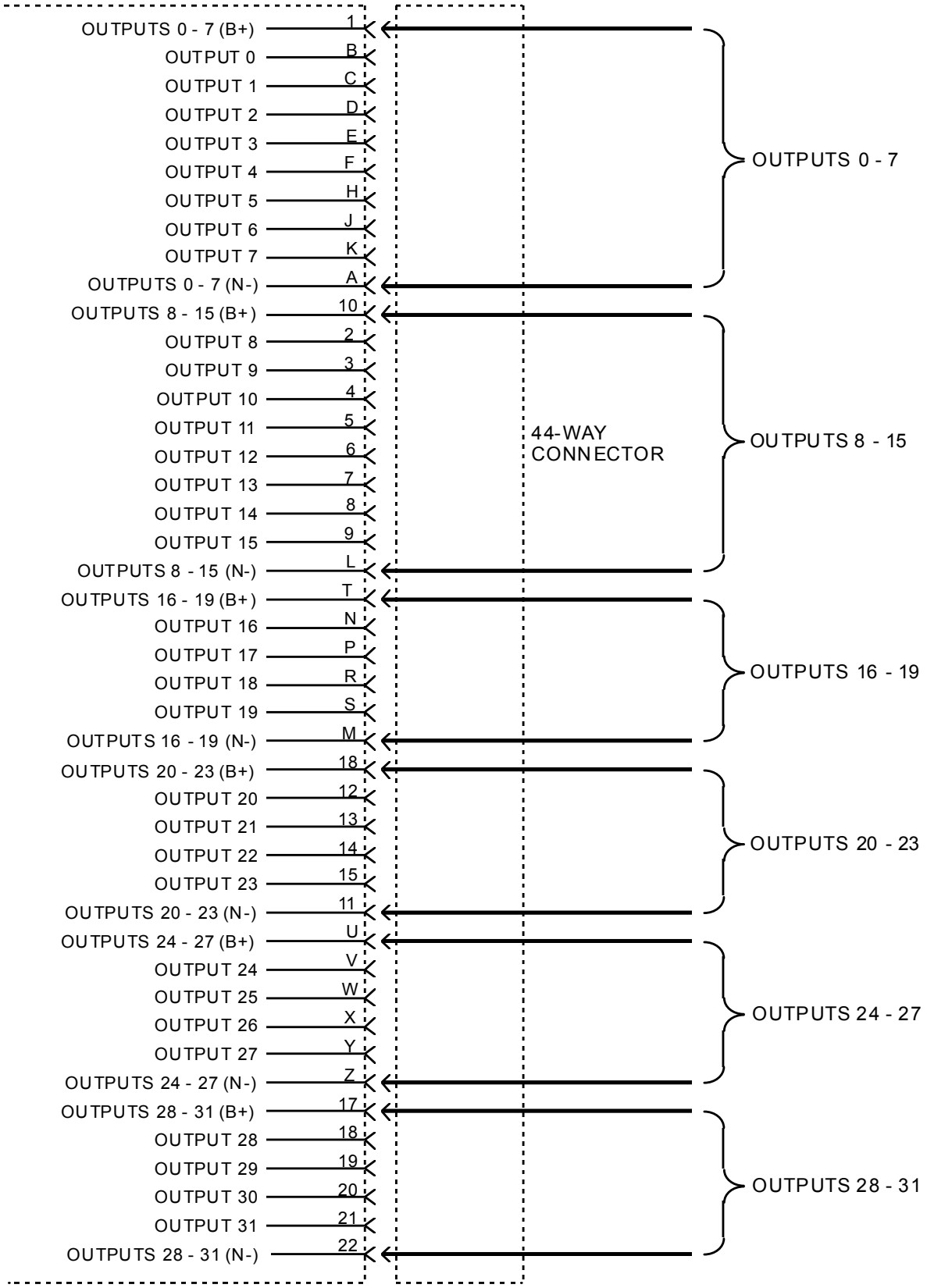

Figure 3-7. Basic Wiring of 32-Bit Output PCB N451441-9601

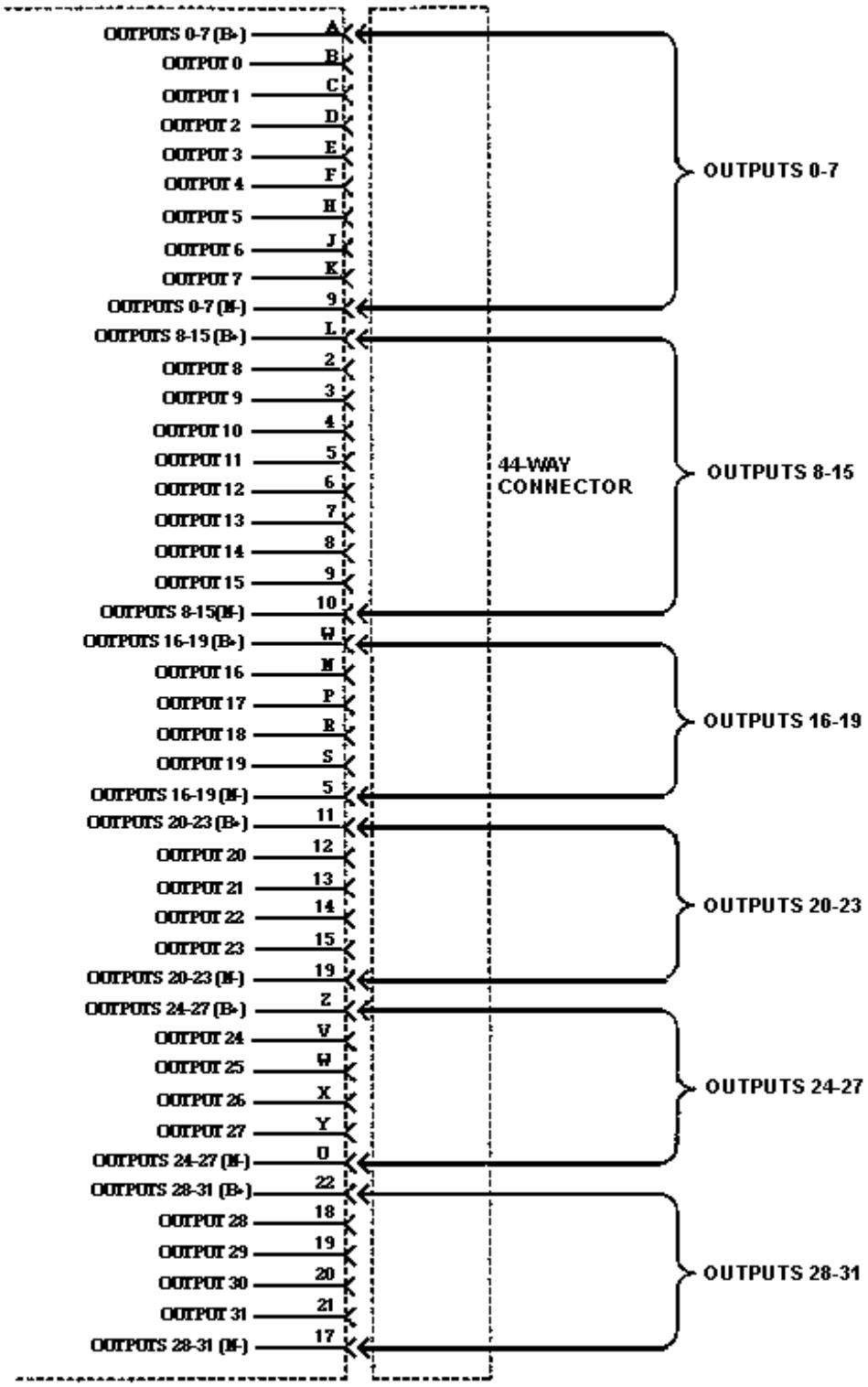

Figure 3-8. Basic Wiring of 32-Bit Output PCB N451441-9801

ALL APPLICATIONS

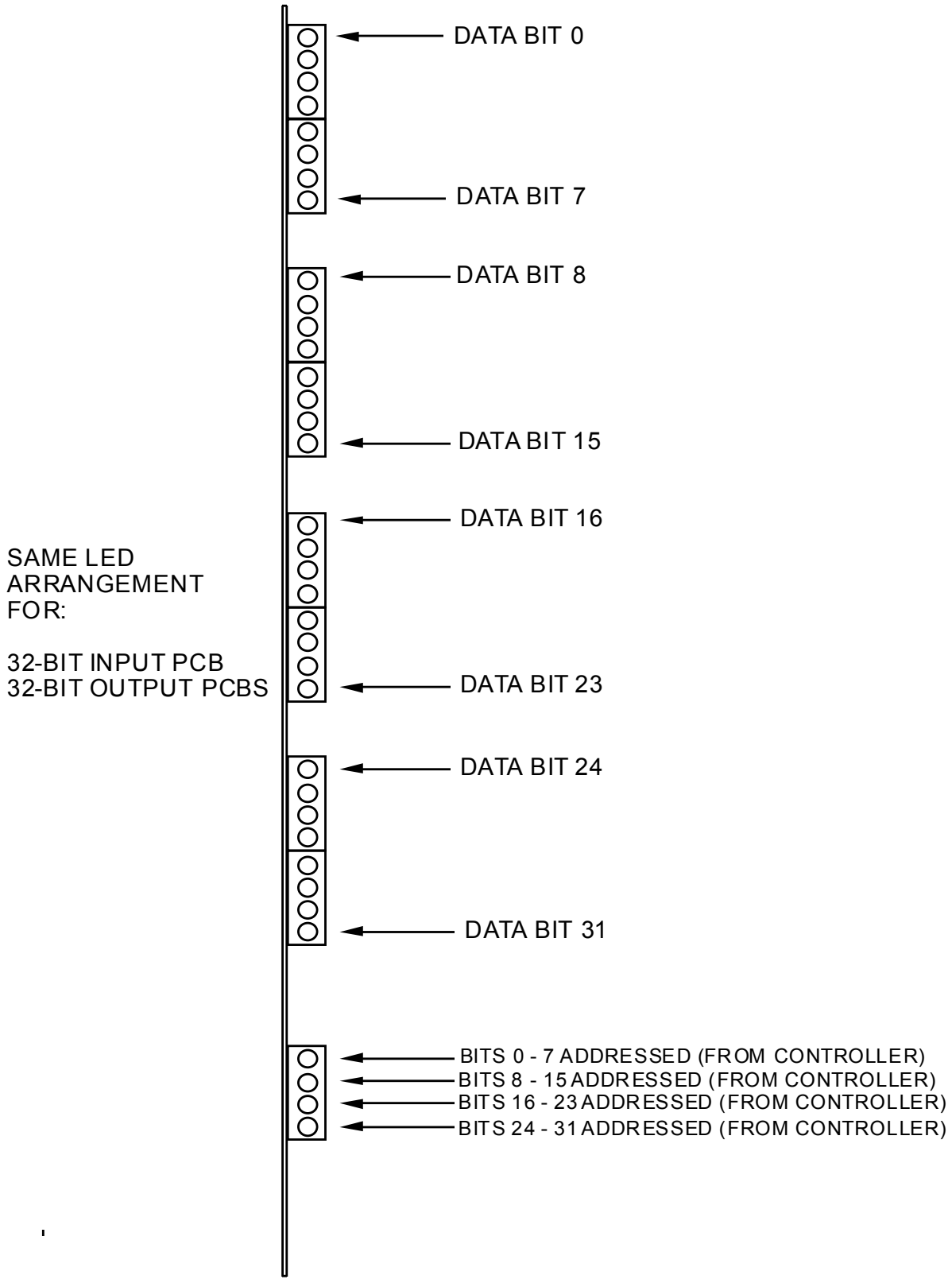

Figure 3-9. 32-Bit I/O Boards LEDs

3.5 FIELD MAINTENANCE

Field maintenance of the 32-Bit Input and Output boards is limited to visual inspection of the boards for defects, checking of LEDs and complete replacement of faulty boards.

No field repairs these should be attempted. A faulty board should be removed from service and returned to US&S for shop repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

3.5.1 Inspection

The 32-Bit Input and Output boards should be periodically inspected in conjunction with inspections of related equipment.

CAUTION

Make certain unit operating power is turned off while removing and reinstalling a 32 Bit I/O PCB, otherwise component damage and/or unreliable operation may result.

In the inspection:

A. Check the board material for fractures or other physical damage.

B. Examine circuit traces on both sides for breaks or unintended cross connections, and check for broken leads on components such as resistors and diodes.

C. Check for evidence of transient voltage (e.g. lightning) damage, for example burned or discolored components.

D. Make sure all plug-in chips are fully inserted with pins properly oriented.

E. Also check the condition of the backplane connectors in the GENISYS® or MICROLOK-PLUS™ cardfile.

ALL APPLICATIONS

3.5.2 Troubleshooting

In the event of an apparent problem with the 32-Bit Input or Output board, perform the following checks:

A. Make certain the board is fully inserted in the GENISYS® or MICROLOK-PLUS™ cardfile.

B. Make certain cardfile power connections are secure.

C. Check board LEDs (Ref. Figure 3-9).

- If one data input or output LED does not light, a problem with the associated input or output circuit is indicated. Group failures of LEDs suggest a problem with the LEDs.

- If a board addressing LED does not light, a problem with the cardfile bus or Enhanced Controller PCB is suggested.

D. Problems with input and output boards can also result from improper application logic programming. Check the application logic for proper assignments of boards to cardfile slots.

E. If the above checks are OK, make certain problems in related circuits and equipment are not causing apparent problems with the 32-Bit Input or Output boards. For example, if the Enhanced Controller PCB is failing to send controls to local circuits, this will appear on the addressed Output board.

SECTION IV CODE LINE INTERFACE PCB N451441-9401 CODE LINE INTERFACE/POWER SUPPLY PCB N451441-9402 POWER SUPPLY PCB N451441-9403

4.1 DESCRIPTION

4.1.1 General Applications

The "-940X" series of PCBs serve several purposes in GENISYS® Series 2000 applications, including:

A. Code Line Interface PCB -9401: Code line interface for Enhanced Controller board installed in GENISYS® or MICROLOK PLUS™ unit. PCB -9401 is installed in GENISYS® Series 2000 Interface Module. Reference Figure 1-3.

B. Code Line Interface/Power Supply PCB -9402: Operating power and code line interface for Enhanced Controller board installed in GENISYS® Series 2000 Interface Module. Module interfaces US&S 500 series or GRS K series DC code line with MICROLOK® system. Reference Figure 1-3.

C. Power Supply PCB -9403: Operating power for Enhanced Controller board installed in GENISYS® Series 2000 Interface Module. Reference Figures 1-1 and 1-2.

D. Power Supply PCB -9403: Operating power for GENISYS® Series 2000 Protocol Converter.

4.1.2 Components (see Figure 4-1)

The -940X series of PCBs are standard GENISYS®/MICROLOK® size PCBs developed from a common circuit board. These PCBs are only designed for installation in the upper slot of the GENISYS® Series 2000 Card Enclosure. They are not compatible with a GENISYS®, MICROLOK-PLUS™ or MICROLOK® cardfile.

PCB -9402 contains two basic circuits: Code line interface and power supply. PCB -9403 contains only the power supply circuitry; code line interface components are absent. PCB -9401 contains only the code line interface circuitry; power supply components are absent. All three boards incorporate the same copper traces on both sides.

The power supply circuitry on the -9402 and -9403 boards is electrically independent from the code line interface circuitry (where present) and only provides regulated voltages for the Enhanced Controller PCB. A separate power supply converter within the code line interface circuitry provides regulated power to the interfacing components. Both power supply circuits accept 9.5 to 35.0V dc external voltage. This voltage enters the board through a filering/clamping circuit with a toggle switch. The toggle switch controls voltage to both the independent power supply circuitry and/or the power converter within the code line interface circuitry.

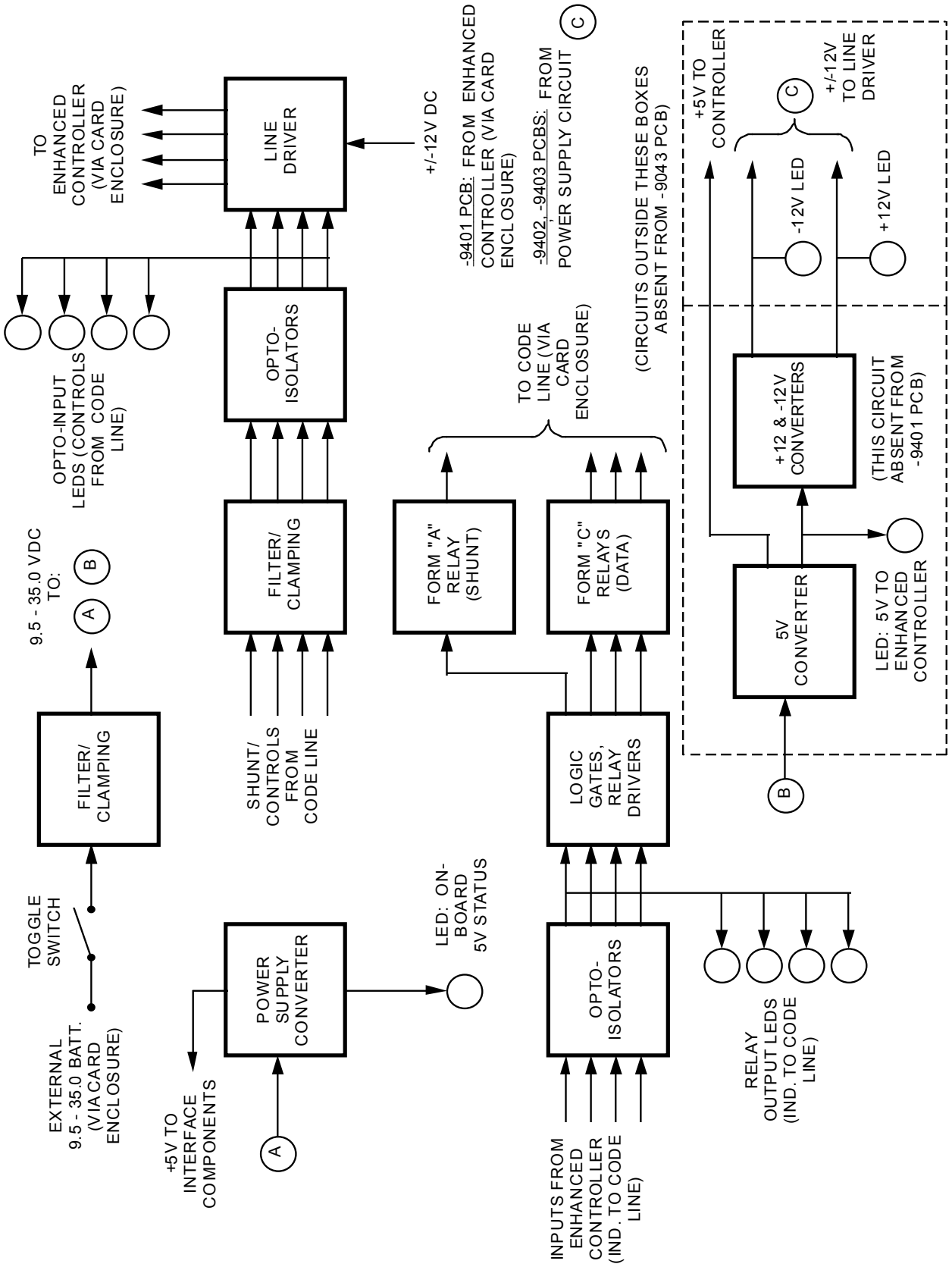

Figure 4-1. -940X Series PCBs - Basic Block Diagram

In the code line interface circuitry, three dual form “C”, mercury-wetted relays generate control outputs for the dc code line, while one dual form “A” relay shunts the code line. These relays are driven by a line driver IC via inputs from the Enhanced Controller PCB. Four opto-isolators interface relay driver inputs to the code line interface from the Enhanced Controller PCB. Inputs from the DC code line are interfaced through four additional opto-isolators. In turn, these inputs are delivered to the Enhanced Controller via a line driver IC operating from +/-12V power.

Both sets of opto-isolators electrically isolate input and output lines from internal circuits to prevent transient voltage damage. LEDs tied to each input and output line (four input, 4 output LEDs) report status of code line controls and indications. Regulated 5V power for the code line circuitry is obtained from a power converter/regulator chip; this converter is not field adjustable. The state of the on-board 5V power is reported with a separate LED.

The independent power supply circuit on the -9402 and -9403 boards includes three power converter/regulator chips providing these outputs (as applicable):

A. +5V for all Enhanced Controller PCB components except serial line drivers and receivers.

B. +12V and -12V for serial line drivers and receivers on the Enhanced Controller, and the on-board line driver for code line inputs to the Enhanced Controller. (On the -9401 board, this line driver receives +/-12V power externally from the Enhanced Controller.)

None of the power converter/regulator chips in the power supply circuitry are field adjustable. An LED is provided for each +5V, +12V and -12V line. Reference Figure 4-2 for LED displays.

4.2 SPECIFICATIONS

US&S Part Nos.:	N451441-9401 (Code Line Interface PCB)
	N451441-9402 (Code Line Interface/Power Supply PCB)
	N451441-9403 (Power Supply PCB)
Board Size:	Standard GENISYS®/MICROLOK® size
Installation:	GENISYS® Series 2000 Card Enclosure - upper slot
Connections:	44-way PCB edge connectors “A” and “B” (to card enclosure backplane plugs)
Power Input:	9.5 to 35.0V dc, 5% ripple (max.)
Power Outputs:	+5V for Enhanced Controller misc. components
	+12V/-12V for Enhanced Controller serial line drivers and receivers, on-board line driver
User Controls:	SPST toggle switch (input power control)

User Displays:	11 or 12 discrete LEDs (per board part no.), I/O and power monitoring
Board Environmental Limits:	-40^{O}C to +70^{O}C 95% relative humidity (non-condensing)

4.3 INSTALLATION AND POWER-UP

4.3.1 Shipment Inspection

Prior to installation, the -940X series PCB should be inspected for possible damage during shipping. Check for loose or missing components, broken solder leads, breaks in tracks, fractures in the board material etc. Damaged boards should be returned to US&S for repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

4.3.2 Pre-Installation Adjustments

Prior to installing the -940X PCB, make certain toggle switch SW1 is in the OFF position (to right as viewed in the GENISYS® Series 2000 Card Enclosure). No other adjustments are required prior to installation.

4.3.3 Installation In Card Enclosure (Ref. Figure 4-2)

The -940X series PCB is installed in the upper slot of the GENISYS® Series 2000 Card Enclosure with the component side facing up.

CAUTION

Make certain unit operating power is tuned off while installing the 940X Series PCB, otherwise component damage and/or unreliable operation may result.

4.3.4 Board Power-Up and LED Displays (see Figure 4-2)

With power to the GENISYS® Series 2000 Card Enclosure turned on, flip toggle switch SW1 to the right. Table 4-1 below lists complete LED displays. Refer to section 2.5.2 for LED power-up and running displays on the Enhanced Controller.

Table 4-1. -940X Series PCBs - LED Displays

LED No.	Used on PCB N451441-	Description	Display
1	-9401, -9402	Output #1 from Enhanced Controller to code line (line shunt)	Lights momentarily when line shunt relay is engerized.
2	-9041, -9402	Output #2 from Enhanced Controller to code line (indication)	Lights momentarily when line control relay is engerized.
3	-9041, -9402	Output #3 from Enhanced Controller to code line (indication)	Lights momentarily when line control relay is engerized.
4	-9041, -9402	Output #3 from Enhanced Controller to code line (indication)	Lights momentarily when line control relay is engerized.
5	-9041, -9402	Input #1 from code line to Enhanced Controller (line shunted)	Lights when normal line polarity is received.
6	-9041, -9402	Input #2 from code line to Enhanced Controller (control)	Lights when reverse line polarity is received.
7	-9041, -9402	Input #3 from code line to Enhanced Controller (control)	Not used in US&S 500 series and GRS K series applications
8	-9041, -9402	Input #4 from code line to Enhanced Controller (control)	Not used in US&S 500 series and GRS K series applications
9	-9401, -9402	On-board +5V power.	Lights steadily when power switch is turned on.
10	All	-12V line driver power	-9401 PCB: -12V line on from Enhanced Controller -9402, -9403 PCBs: -12V line on from on-board supply
11	-9402, -9403	+5V power to Enhanced Controller components	Lights steadily when power switch is turned on.
12	All	+12V line driver power	-9401 PCB: +12V line on from Enhanced Controller -9402, -9403 PCBs: +12V line on from on-board supply

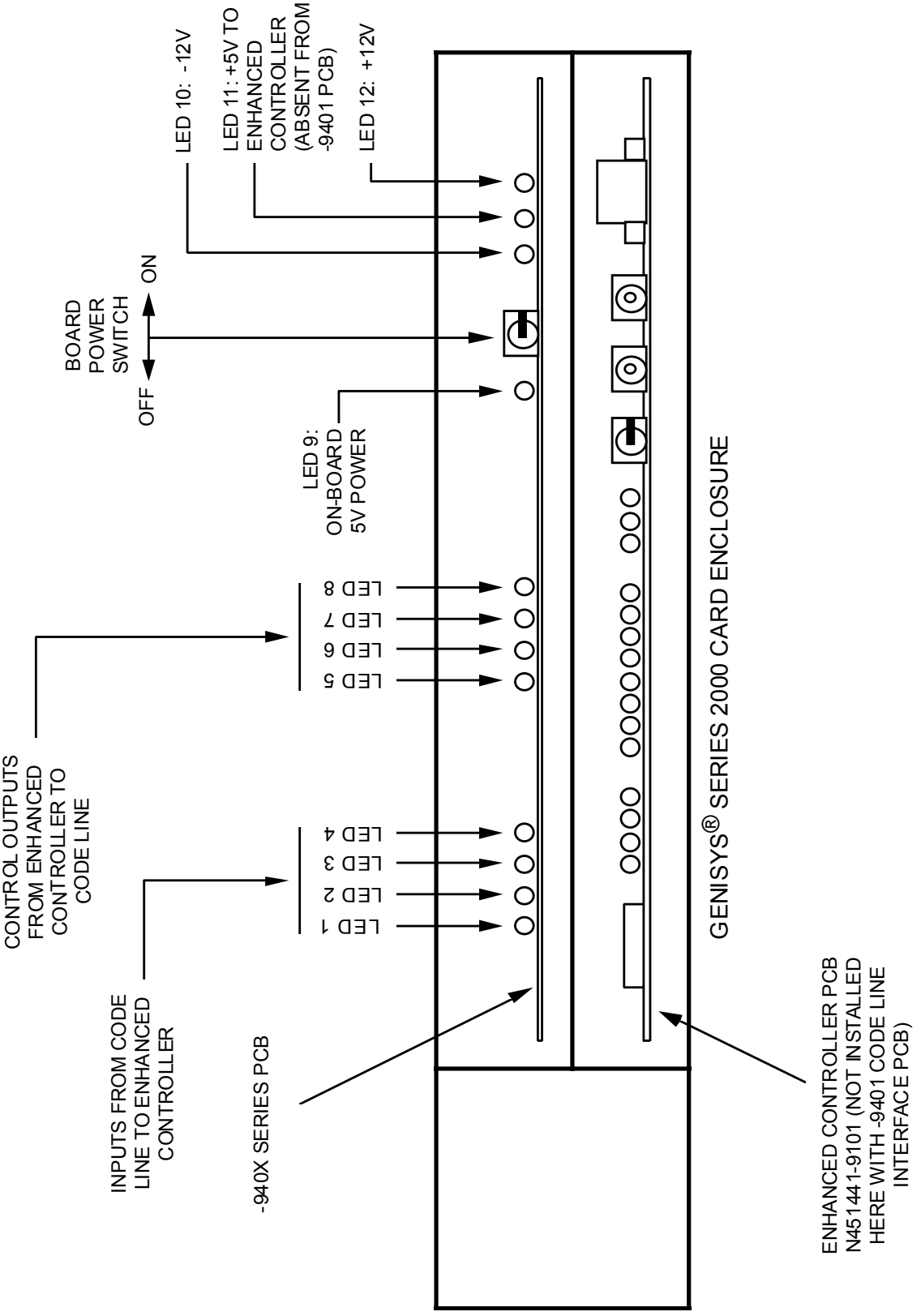

Figure 4-2. -904X Series PCBs - Installation and LED Displays

4.4 FIELD MAINTENANCE

Field maintenance of the GENISYS® Series 2000 -940X boards is limited to visual inspection of the boards for defects, checking of LEDs and complete replacement of faulty boards.

No field repairs on a -940X series PCB should be attempted. A faulty board should be removed from service and returned to US&S for shop repair or replacement. For service information call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC 29006

4.4.1 Inspection

The -940X series boards should be periodically inspected in conjunction with inspections of related equipment.

Prior to removing the board for inspection, move the board's toggle switch to the right (power off).

CAUTION

Make certain unit operating power is turned off while removing and reinstalling a 940X Series PCB, otherwise component damage and/or unreliable operation may result.

In the inspection:

A. Check the board material for fractures or other physical damage.

B. Examine circuit traces on both sides for breaks or unintended cross connections, and check for broken leads on components such as resistors and diodes.

C. Check for evidence of transient voltage (e.g. lightning) damage, for example burned or discolored components.

D. Make sure all plug-in chips are fully inserted with pins properly oriented.

E. Also check the condition of the backplane connectors in the GENISYS® Series 2000 Card Enclosure.

4.4.2 Troubleshooting

In the event of an apparent problem with the -940X series board, perform the following checks:

A. Make certain the board is fully inserted in the GENISYS® Series 2000 Card Enclosure.

B. Make certain Card Enclosure power and code line connections are secure (refer to section 6.X).

C. Check the board LEDs (Ref. Figure 4-3).

   1. If the 5V on-board power LED does not light, the board may not be receiving external power. Power supply problems with the -9402 and -9403 boards will be shown on the Enhanced Controller PCB, which will be off.

   2. If the 5V on-board power LED is lit, but remaining LEDs are dark or not showing proper displays (per section 3.3.4), the board should be replaced.

D. If the above checks are OK, make certain problems in related circuits and equipment are not causing apparent problems with the -940X board. For example, if the Enhanced Controller PCB is failing to send indications to the code line, the four indication LEDs on the -940X board will be dark.

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ALL APPLICATIONS

GENISYS® Series 2000 Surge Suppressor/Serial Interface PCBs are used in ATCS MCP (office and field) and serial code line applications to protect the Enhanced Controller from transient voltages (e.g. lightning-induced) on the serial communciations interfaces. In addition, the PCBs interface RS-232 and RS-422 signal levels to the Enhanced Controller PCB.

PCB -8901 is used for all RS-232 serial interfaces, but not the RS-422 interface used in the MCP end of the ATCS communications link. PCB -8902 is used only for the RS-422 interface to the MCP.

Stand along mounting panel N451892-1401 allows 19" rack mounting of the -8901 and -8902 PCBs adjacent to an existing GENISYS® or MICROLOK-PLUS™ cardfile, or the GENISYS® Series 2000 card enclosure. GENISYS® and MICROLOK-PLUS™ cardfiles are also available with built-in mounting panel for the PCBs (contact US&S for ordering information.) Up to three PCBs may be mounted on the stand alone or cardfile-mounted panels using stand-off posts and screws.

Key components of the -8901 and -8902 PCBs include one 25-pin "D" male connector for the cable connection to the Enhanced Controller PCB, and one 25-pin "D" female connector for the cable connection to the external device (e.g. modem or serial line carrier). Transient voltage protection for data lines is provided by 14 bi-directional Tranzorbs. Two single direction Transzorbs provide transient voltage protection for +12 and -12V lines.

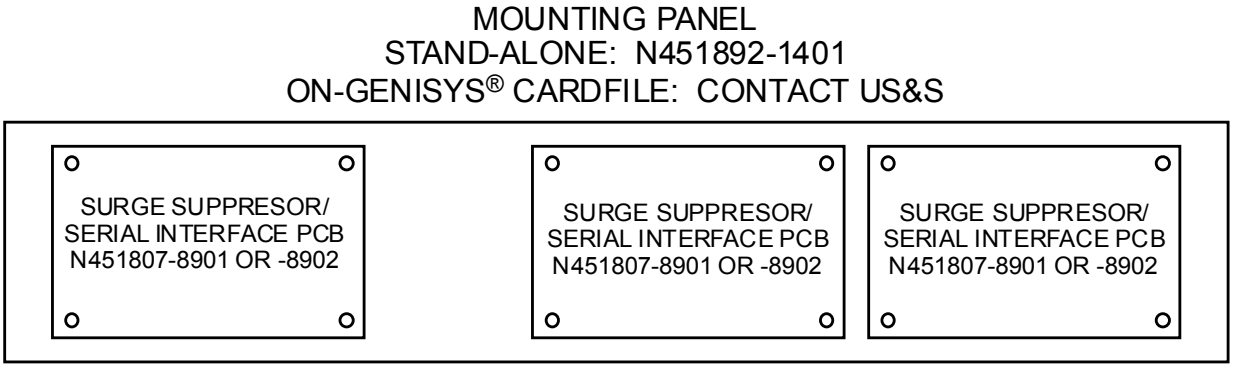
A level converter circuit on the -8902 board changes RS-232 data transmit and transmit clock signals to differential RS-422 levels. This circuit is absent form the -8901 PCB (not required).

The GENISYS® Series 2000 Surge Suppressor/Serial Interface PCBs are not field repairable. If faulty, they should be returned to US&S for repair or replacement. For service information, contact:

Union Switch & Signal Inc.
645 Russell Street
Batesburg, South Carolina 29006

Figure 5-1 shows the general arrangement and application of the Surge Suppressor/Serial Interface PCBs.

ALL APPLICATIONS



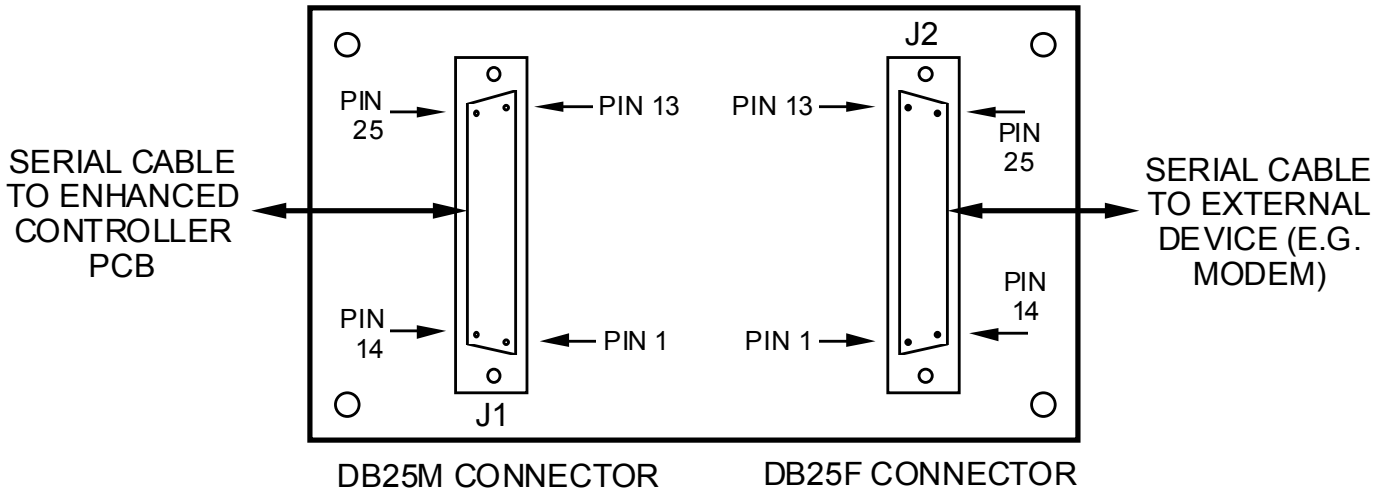


Figure 5-1. Surge Suppressor/Serial Interface PCBs

SECTION VI INTERFACE MODULE CARD ENCLOSURE (N451891-0102)

The GENISYS® Series 2000 Card Enclosure is provided to house the DC Code Line Interface PCB (-9401) and, for certain applications, the Enhanced Controller PCB. The most common application of the enclosure is connection of a GENISYS® or MICROLOK-PLUS™ unit to a DC code line. In this application, the enclosure houses only the DC Code Line Interface PCB, while the Enhanced Controller PCB is housed in the GENISYS® or MICROLOK-PLUS™ cardfile.

When the application requires an interface between a MICROLOK® or MICROTRAX® End-of-Siding System, the card enclosure also contains the Enhanced Controller PCB. In this configuration, the enclosure also contains the alternate Code Line Interface/Power Supply PCB, which includes a logic-level power supply for the Enhanced Controller. This configuration is used when the external unit (to which the Enhanced Controller is connected) is not capable of powering the controller. Because of the many possible system configurations, the enclosure and appropriate PCBs must be ordered separately.

The GENISYS® Series 2000 Card Enclosure is designed for installation in a standard 19” equipment rack. Boards are inserted horizontally in two slots with two internal backplane connectors each. Installed boards may be accessed through a hinged front cover. The cover includes a transparent window for viewing LEDs, and a cut-out for connecting a diagnostic PC 9-pin plug to the Enhanced Controller PCB (when installed). To open the front cover, press the two side latches downward.

All power and data line connections to the card enclosure are made on the back panel of the unit. Connectors include three 25-pin “D” plugs for serial communications with GENISYS®, MICROLOK-PLUS™, MICROLOK®, MICROTRAX® EOS, modems and other devices per the application. Eight 8-way terminal strips accommodate power input and dc code line parallel I/O discrete wiring. Silkscreen labeling on the enclosure back panel identifies parallel wiring terminals. See Figure 6-1 for the card enclosure back panel layout. Tables 6-1 and 6-2 list all back panel connector pin-outs.

In addition to power and data connections, the card enclosure back panel includes two screws for card enclosure grounding. US&S recommends that the enclosure be grounded to rack prime ground to minimize the effects of possible voltage transients.

The GENISYS® Series 2000 Card Enclosure is not repairable in the field. If determined to be faulty, it should be returned to US&S for repair or replacement. For service information, call 1-800-652-7276 or write:

Union Switch & Signal Inc.
The Service Shop
645 Russell St.
Batesburg, SC

ALL APPLICATIONS

Table 6-1. GENISYS® Series 2000 Card Enclosure Serial Port Pin-Outs

Conn. No.	Pin No.	Description	Applications
J3	1	Not Used*	
	2	MTXD (Master Transmit Data)	GENISYS®
	3	MRXD (Master Receive Data)	GENISYS®
	4	MRTS (Master Request to Send)	GENISYS®
	5, 6	Not Used*	
	6		
	7	MCOM (Master Common)	GENISYS®
	8	MDCD (Master Data Carrier Detect)	GENISYS®
	9-25	Not Used*	
J4	1	Not Used*	
	2	S1TXD (Slave Port Transmit Data)	GENISYS®, ATCS MCP
	3	S1RXD- (Slave Port Receive Data "-")	GENISYS®, ATCS MCP
	4	S1RTS (Slave Port Request to Send)	GENISYS®
	5, 6	Not Used*	
	7	S1COM (Slave Port Common)	GENISYS®, ATCS MCP
	8	Not Used*	
	9	+12V	GENISYS®, ATCS MCP
	10	-12V	GENISYS®, ATCS MCP
	11	Not Used*	
	12	S1DCD+ (Slave Port Data Carrier Detect "+")	GENISYS®
	13-15	Not Used*	
	16	S1RXD+ (Slave Port Receive Data "+")	GENISYS®, ATCS MCP
	17	S1RXC- (Slave Port Receive Clock "-")	ATCS MCP
	18	S1RXC+ (Slave Port Receive Clock "+")	ATCS MCP
	19	Not Used*	
	20	S1DTR (Slave Port Data Terminal Ready)	GENISYS®
	21-23	Not Used*	
	24	S1TXC (Slave Port Transmit Clock)	ATCS MCP
	25	Not Used*	
J5	1-25	Not Used*	

*Not used for the specific system applications in this manual. Other applications may utilize these pinouts.

Table 6-2. GENISYS® Series 2000 Card Enclosure Parallel Port Pin-Outs

Conn. No.	Pin No.	Description	Applications
J1	1	+12V	US&S 500, GRS K
	2, 3	Not used*	
	4	0 volts	US&S 500, GRS K
	5-7	Not used*	
	8	-12V	US&S 500, GRS K
J2	1, 2	Not Used*	
	3	Code Line Input 2	US&S 500, GRS K
	4	Code Line Input 1	US&S 500, GRS K
	5, 6	Not used*	
	7	Code Line Output 2	US&S 500, GRS K
	8	Code Line Output 1	US&S 500, GRS K
J6	1	External Battery "-"	US&S 500, GRS K
	2-7	Not used*	
	8	External Battery "+"	US&S 500, GRS K
J7	1-8	Not used*	
J8	1	Code Line FSR (see Figures 2-13, 2-14, 2-15)	US&S 500, GRS K
	2-7	Not used*	
	8	Code Line FSR (see Figures 2-13, 2-14, 2-15)	US&S 500, GRS K
J9	1-6	Not used*	
	7	Code Line Filter L2 Output (see Figures 2-13, 2-14, 2-15)	US&S 500, GRS K
	8	Code Line Filter L1 Output (see Figures 2-13, 2-14, 2-15)	US&S 500, GRS K
J10	1-8	Not used*	
J11	1	Not used*	
	2	Code Line Filter L2 Input (see Figures 2-13, 2-14, 2-15)	US&S 500, GRS K
	3	Code Line Filter L1 Input (see Figures 2-13, 2-14, 2-15)	
	4-8	Not used*	

*Not used for the specific system applications in this manual. Other applications may utilize these pinouts.

ALL APPLICATIONS

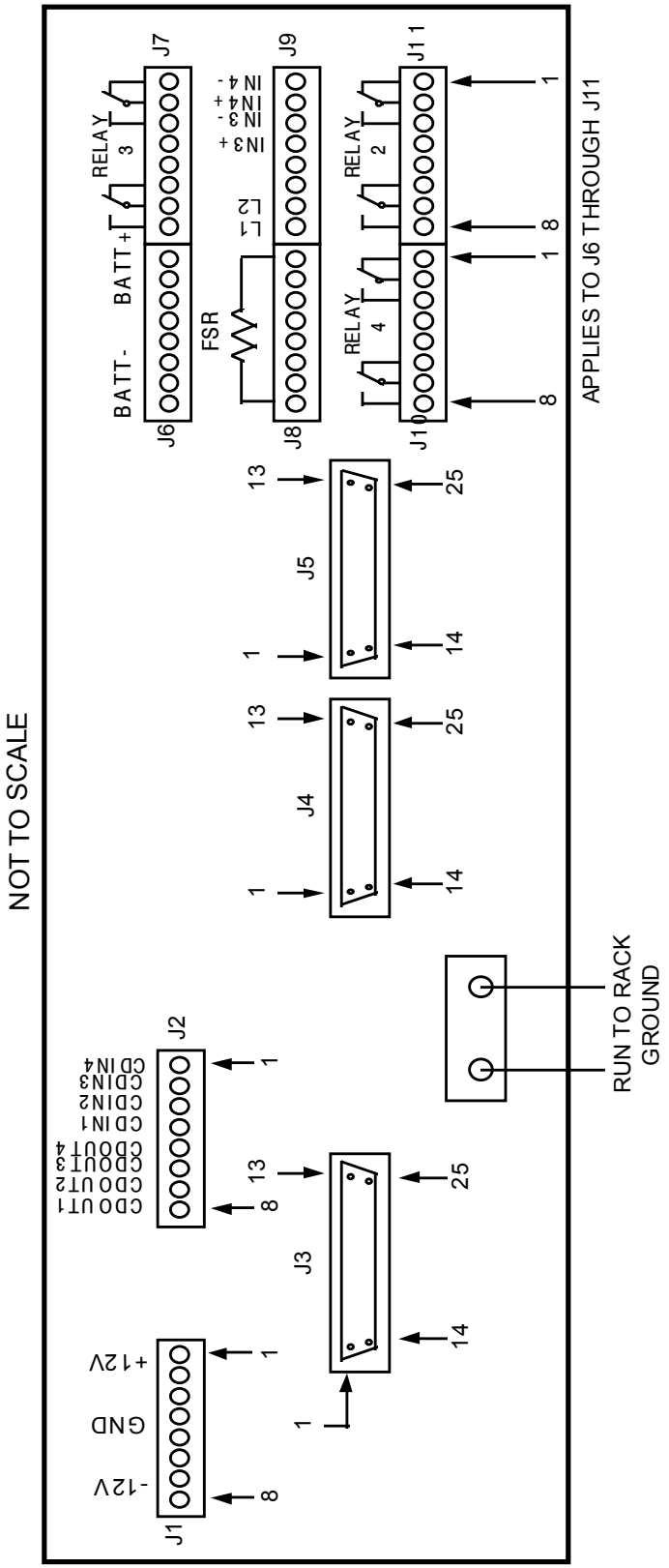


Figure 6-1. Card Enclosure Back Panel Connector Arrangement